

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF STATISTICS.

MISCELLANEOUS SERIES.

REPORT No. 7.

---

AN AGRICULTURAL SURVEY

OF

WYOMING.

---

PREPARED UNDER THE DIRECTION OF THE STATISTICIAN

BY

JOHN W. HOYT,

FORMER GOVERNOR OF WYOMING.

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PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

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WASHINGTON:

GOVERNMENT PRINTING OFFICE.

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## LETTER OF SUBMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
DIVISION OF STATISTICS,  
*Washington, D. C., February 14, 1893.*

SIR: I respectfully submit for publication a report upon the agricultural resources of Wyoming, and the progress and status of their development. It is one of a series of agricultural surveys of States, undertaken to show the condition and possibilities of agriculture and the peculiarities and adaptabilities of various sections of the national domain. It was deemed desirable to show, in concise form and under authoritative auspices, the physical characteristics of Wyoming, its climate, the distribution of its productive area, its water supply, and progress and results of irrigation, its live-stock interests, its agricultural development, the possibilities of fruit culture, and other matters relating to rural production and the marketing of the results of rural labor.

The data necessary for a comprehensive yet compact exhibit of the agriculture of Wyoming has been for some time in progress of collection, through our correspondents and agents. When ready to take up the work of compilation and generalization, the services of Hon. John W. Hoyt, former governor of Wyoming Territory, were employed, who sought through additional circulars and letters to individuals representing all lines of rural development to complete the material required. Thorough knowledge of every part of the Wyoming area has been utilized in digesting this material, in the confident hope of being able to present a full, fair, and unbiased estimate of the agricultural possibilities and present rural standing of this interesting mountain district.

Respectfully,

J. R. DODGE,  
*Statistician.*

Hon. J. M. RUSK,  
*Secretary.*

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# AN AGRICULTURAL SURVEY OF WYOMING.

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As a field for agricultural inquiry Wyoming is especially interesting, first, because its cultivated areas have an average altitude greater than those of any other political division of the United States, with a consequent need of irrigation, thus presenting exceptional conditions; and secondly, because of the recentness of its organization as a distinct civil division, and its still more recent beginnings of agricultural development.

## AREA AND CONFIGURATION.

Embracing all that portion of the country between the forty-first and forty-fifth parallels of latitude and between the one hundred and fourth and one hundred and eleventh meridians west from Greenwich, it has an area of 97,575 square miles, very nearly equal to that of New York, New Jersey, and Pennsylvania combined, or one and a half times that of all New England.

In general terms mountainous, it is not so in the same degree as Colorado, whose lofty mountains are so bunched as to constitute the dome of the continent, but with lower ranges, and those completely broken down at many points and so widely separated as to make broad valleys and plains, with a total area greater than that of any one of the older States excepting Texas, and an average elevation of about 6,000 feet above the level of the sea.

Wyoming is, in fact, a vast region of undulating plains, relieved by detached ranges and broken spurs of mountains, some of them with elevated spines and lofty peaks, the intervening plateaus and outlying plains being broadly grooved or deeply furrowed in every direction by very considerable rivers, with their numberless branches.

The general direction of what was once an uninterrupted portion of the Rocky Range in Wyoming is northwesterly and southeasterly, its first appearance on the southern boundary being a little east of a middle point on said boundary; its disappearance, at the northwest corner of the State.

The Laramie Range, crossing the southern boundary but 60 miles west of the southeastern corner of the State, and having a direction

nearly north for 150 miles, makes a right angle toward the west, and is thereafter known as the Sweetwater Range until it finally disappears in the rolling plains which slope towards the Green River on the south and west, leaving toward the northwest traces, in the form of broken ridges and hills, of a former junction with the main Rocky Range.

The Big Horn Range occupies the middle northern portion of the map, and has a course but little west of north for more than 130 miles to its termination, not far beyond the Montana line.

Of the various detached spurs and aggregations of mountain masses, some lofty, like those which bound the Yellowstone Park on its eastern and southern sides, others low and without very definite line, like the Black Hills occupying the boundary between Wyoming and South Dakota, it will be more convenient to speak in other connections.

Geologically speaking, and in very general terms, the crests of the mountain ranges and the body of them are composed of feldspathic granite, syenite, and gneiss, with the Silurian, Devonian, Carboniferous, Triassic, Jurassic, and Cretaceous formations on their flanks; some showing themselves in one locality and some in another, according to the extent of upheaval or the amount of erosive action. The higher plains are quite largely Cretaceous, overlaid by sandstones of the Tertiary series, by gravel and drift.

Dealing with the subject a little more specifically, and yet in those general terms suited to the agricultural end in view, it may be said of a broad extent of country in the southeastern portion of the State, east of the Laramie range, that it is overlaid with marls, sands, or sandstone, and with clays of the White River group. Northeastern Wyoming is quite similar in its geological features. Where were once several minor ranges of mountains are now low hills completely grassed over.

From the Platte to the northern boundary, and from the Big Horn Mountains to the Black Hills, we find a vast region of plateaus lower than those of southern Wyoming, indeed as low at points toward the northeast as 3,000 feet, but otherwise similar. Erosion has done its work more effectually, as seen by alternation of hill and plain, deeply furrowed valley, tortuous ridge, and elevated butte.

#### CHARACTER OF THE SOILS.

The subject of soils is manifestly one of primary importance, since upon its determination rests the productiveness or nonproductiveness of a given region or body of land. It requires to be dealt with from three points of view—the physical, geological, and chemical. Thus a soil may be so hard and compact as to prevent the percolation of water, the absorption of water from the atmosphere, and such aëration as is essential to the physiological functions of the plant, or it may be so loose, porous, and coarse mechanically as to fail either to hold the requisite moisture or to supply to the plant its food in form sufficiently

minute to serve as food for the crop to be grown. Again, the soil being physically what is desired, may have been derived so almost exclusively from one of the geological formations as to be deficient in some of the necessary constituents; in which case the plant, if able to live at all, has an impoverished existence and can not produce a valuable crop. So likewise a soil, meeting all the conditions physically and geologically considered may have one or more chemical constituents in such superabundance as to prove hurtful to the plant, as where the alkaline salts are in such excess as to prove corrosive.

With very partial exceptions, the soils of Wyoming are of the best in all these respects. The mountain ranges in their uplift have so far exposed the several rock formations that both the physical and geological conditions are well fulfilled. There are no broad areas of exclusively volcanic rocks, as in some other states, no extensive barren wastes of simple sand, like those of Sahara. And, on the other hand, the localities are few and not very extensive where the alkalis are present in such proportion as to render the soils wholly unfit for cultivation.

Using the popular terms for their description, the soils of Wyoming, like those of the neighboring Rocky Mountain States, are about as follows: In the valleys a sandy loam, more or less enriched and darkened by the products of vegetable decomposition; on the uplands a sandy loam, usually with a larger proportion of clay and with gravel, either fine or coarse and, where in large amount, forming a gravelly loam. In some districts there is a preponderance of heavy clay loam approaching what is commonly called "gumbo." In others there is so much sand as to make the term sandy appropriate; and in still others, as along the foot of the Black Hills on the border of Dakota, on either side of the Big Horn mountains, and in some other districts, the gypsum formations are so prominent as to give to the soils the name of "gypsum"—"red" or "gray" according to the proportion of iron contained. Considering them with reference to those chemical constituents which determine the degree of fertility, there is, of course, much diversity—a variety as great as that of the exposures of the various rock formations by whose disintegration they were formed.

In the absence of analyses of the several classes of Wyoming soils, I give some of the results furnished by the agricultural experiment station at Fort Collins, Colo., of the examinations made of such as are practically the same, having been taken from corresponding districts in various portions of that adjoining State. The "sandy" soil was from the orchard at the experiment station in the valley of the Arkansas; the "clay loam" from the nursery at the same place; the "sandy gravelly loam" from the station at San Luis; the "heavy clay" known as "adobe," from Yuma; the "garden soil" from the station at Collins, having been manured for a crop of oats.



TABLE 1.—*Constituents of Wyoming soils.*

Constituents.	Sandy soil.	Clay loam.	Sandy, gravelly loam.	Adobe.	Garden soil manured for roots.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Moisture .....	3.15	3.47	1.66	2.77	2.66
Insoluble silica .....	79.19	82.24	83.24	84.52	82.40
Hydrated silica .....	7.56	4.53	4.12	5.82	5.12
Soluble silica .....	.08	.06	1.00	.04	.04
Iron ( $\text{Fe}_2\text{O}_3$ ) .....	3.30	3.05	4.78	2.16	2.99
Alumina ( $\text{Al}_2\text{O}_3$ ) .....	4.53	5.23	5.59	3.98	3.59
Phosphoric acid ( $\text{P}_2\text{O}_5$ ) .....	.23	.22	.23	.14	.29
Calcium ( $\text{CaO}$ ) .....	2.80	1.28	.67	1.46	.91
Magnesia ( $\text{MgO}$ ) .....	.97	.97	.54	.69	.69
Potash ( $\text{K}_2\text{O}$ ) .....	.23	.27	.41	.39	.66
Soda ( $\text{Na}_2\text{O}$ ) .....	.41	.21	.69	.29	1.04
Sulphuric acid ( $\text{SO}_3$ ) .....	.08	.05	.04	.05	.11
Chlorine ( $\text{Cl}$ ) .....	.008	.01	.004	.008	.007
Carbonic acid ( $\text{CO}_2$ ) .....	4.97	3.68	2.13	4.40	2.95
Volatile and organic matter .....	3.39	3.05	1.39	2.01	5.03
	100.20	100.33	100.74	100.17	100.72
Nitrogen .....	.04	.02	.01	.01	.03
Coarse gravel .....	10.30	12.41	30.00	16.39	24.39
Fine material .....	89.70	87.59	70.00	83.61	75.61

Since the effect of alkali is to injure the crown roots by corrosive action and to destroy the tilth of the soil, it is fortunate that but few localities in Wyoming have the alkaline character in so marked a degree as to make this a serious condition.

The general fertility of the soils of the State is sufficiently apparent from the crops produced—some of them without precedent in the history of the country.

#### CLIMATE.

The climate of Wyoming may be termed continental in contradistinction to that of the great valley and coast areas east and west of the mountain region—continental because so much less determined by oceanic causes. With its exceptional altitude and the consequent thinness, dryness, and coolness of the atmosphere; with such interruption of the Pacific air currents as is afforded by the Sierra Nevada and Cascade ranges of mountains, yet with gaps here and there for their partial admission, and with that larger local seclusion for many of its interior valleys and plateaus afforded by so many protecting minor ranges, spurs, and circumjacent hills—with all these modifying conditions, Wyoming has a climate so differing, not only from that of the other great divisions of the country, but also in different sections within its own limits, that it may be considered exceptionally complex enough to require very special study at various points; and for this reason it has seemed proper to include in this account the results of observations at such places as present special features, and as are able to furnish a record running through a period of years.

#### BAROMETRIC COMPARISONS.

The lightness of the atmosphere at an elevation of 5,000 feet and over is so marked as to affect not only the force of winds but also the

physiological conditions of men and animals, and to modify the character of vegetation itself. Accordingly, barometric measurements are taken wherever meteorological observations are intended to be at all complete.

Excluding such as are not deemed necessary, we present simply the data furnished by the Weather Bureau for Cheyenne, Fort Bridger, Fort Washakee, and Fort McKinney, situated in the southeastern, southwestern, northwestern, and northeastern portions of the State, respectively; giving in each case the mean reduced barometer, that is to say, the mean for each month of the year reported, as reduced to the standards of 32° F., and to sea level.

TABLE 2.—*Annual mean reduced barometer records.*

## CHEYENNE, WYO.\*

[Lat., 41° 08'; long., 104° 48'; elevation, 6,105 feet.]

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	30.156	30.115	30.231	29.942	29.858	29.801	29.811	29.835	29.938	30.099	30.161	30.251
1886.....	30.113	30.194	30.049	29.882	29.938	29.805	29.801	29.907	29.946	29.993	.....	.....
1887.....	.....	.....	30.022	29.875	29.908	29.829	29.962	29.921	29.994	30.106	30.066	30.025
1888.....	30.082	29.994	30.011	30.032	29.900	29.759	29.960	30.029	30.098	30.020	30.162	30.134
1889.....	30.124	30.148	30.070	30.017	29.933	29.951	29.915	29.953	30.006	30.114	30.229	29.998
1890.....	30.057	30.006	29.993	30.013	29.894	29.866	29.919	29.984	30.017	30.030	30.233	30.092
1891.....	30.131	29.830	29.966	29.969	29.988	29.838	29.982	30.006	30.008	30.174	30.081	.....

\* Observations were made tri-daily from 1885 to June 30, 1888; thereafter twice daily.

## FORT BRIDGER, WYO.

[Lat., 41° 28'; long., 110° 30'; elevation, 6,643 feet.]

1886.....	.....	.....	.....	.....	.....	(*)	29.970	30.011	30.055	30.196	30.140
1887.....	30.019	30.019	30.129	29.922	29.941	29.835	29.967	29.895	29.993	30.101	30.134
1888.....	30.179	30.111	29.996	30.046	29.894	29.810	30.000	30.034	(†)	.....	.....

\* No record of reduced barometer prior to August 1, 1886.

† Station closed September 15, 1888.

## FORT MCKINNEY, WYO.

[Lat., 44° 23'; long., 06° 46'; elevation, 5,000 feet.]

1888.....	.....	.....	.....	.....	.....	(*)	29.958	29.997	30.035	30.002	30.130	30.099
1889.....	30.142	30.196	30.034	29.980	29.898	29.886	29.880	29.858	29.967	30.040	30.151	29.962
1890.....	30.136	30.064	29.980	29.994	29.891	29.831	29.818	29.864	29.922	29.986	30.120	30.146
1891.....	30.222	30.070	30.120	30.033	30.044	29.879	29.972	29.969	29.982	30.152	30.116	.....

\* No record of reduced barometer prior to July 1, 1883.

## FORT WASHAKIE, WYO.

[Lat., 43° 01'; long., 108° 54'; elevation, 5,580 feet.]

1888.....	.....	.....	.....	.....	.....	(*)	29.952	30.015	30.052	30.012	30.185	30.230
1889.....	30.258	30.197	30.048	30.007	29.934	29.960	29.820	29.944	30.014	30.096	30.209	30.008
1890.....	30.142	30.020	29.999	30.022	29.911	20.908	29.922	29.975	30.019	30.075	30.262	30.173
1891.....	30.204	29.948	30.016	29.998	29.962	29.856	(†)	.....	.....	.....	.....	.....

\* No record of reduced barometer prior to July 1, 1883.

† Station closed June 30, 1891.

Notwithstanding the slight difference between these readings and those at the sea level, the practical effect is quite noticeable in that tornadoes are rarely or never known in the mountains, in the diminished violence of winds having a great velocity, in the low degree of temperature at which water boils, in the length of time for this reason required for the cooking of food by boiling, in the more frequent inhalation necessary to supply the lungs with the requisite oxygen, in the more blistering effect of the sun's rays, and in yet other results that need not be mentioned here.

#### TEMPERATURE.

Temperature is usually and properly considered the chief element of climate, since to it not only the organic but also the inorganic world is subject in the most marked degree. Moreover, the circumstances which modify it are so many and admit of so many variations that no one would assume to predict the range of the thermometer in any given locality, although knowing its exact place on the map of the world and also its altitude. Elevation, configuration, proximity to bodies of water, exposure to aerial currents, with all the observations to which each of these and other elements are subject, must enter into the problem.

Experience and meteorological observations together have furnished data sufficient to warrant the general statement, however, that the temperature of Wyoming is not only more conducive to the comfort of man and beast than strangers to it are wont to imagine, but that it is at once so moderate and so generally equable as to have given to that region high rank among the most agreeable of climates in the world. The mercury does sometimes reach a low point, as will be seen by the subjoined tables; but the extremes are seldom reached, and when they come are so much more easily borne because of the dryness of the atmosphere than in other portions of the country that but for the evidence furnished by the thermometer the degree of cold would never be suspected by those who experience it. On the other hand, it rarely or never reaches a height in summer so painfully common at points near the level of the sea.

As a matter of fact, the summers are cool and invigorating; the autumn and early winter sunny and delightful; leaving the latter part of winter and early spring, like the same season in most other quarters, to be simply escaped, if convenient—but only to such a degree as that of southern California even then; for notwithstanding the frequent light snow falls and the rather disagreeable prevalence of windstorms, this season is also quite as tolerable in Wyoming as in many other States.

While these facts pertain more directly to the meteorological conditions of comfortable living, they are also of prime importance in an investigation of the agricultural capabilities of the country, since

neither plants nor domestic animals can be most profitably produced where such conditions are essentially wanting.

In order to furnish the data for a conclusion upon these matters, we here present the results of observations in the several sections of the State; first showing the extremes of heat and cold throughout the years therein noted; secondly, the mean daily range for the same places and times; and, thirdly, the mean temperature for each of the four seasons and for the year, Fahrenheit being the standard in all cases.

TABLE 3.—*Record of annual maximum temperature (degrees Fahrenheit).*

CHEYENNE, LARAMIE COUNTY, WYO.

[Lat., 41° 08'; long., 104° 48'; elevation, 6,105 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	51	52	61	65	79	81	90	87	85	75	67	64
1886.....	51	63	66	73	85	89	96	92	83	74	.....	.....
1887.....	.....	.....	68	76	84	90	90	92	86	82	70	56
1888.....	64	56	64	76	78	93	97	86	88	72	62	61
1889.....	51	54	62	72	78	87	95	92	87	81	61	60
1890.....	59	61	62	72	80	90	92	89	84	69	66	61
1891.....	49	52	56	77	78	81	87	89	86	74	75	.....

FORT BRIDGER, UINTA COUNTY, WYO.

[Lat., 41° 28'; long., 110° 30'; elevation, 6,643 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	.....	.....	.....	.....	.....	.....	.....	*86	69	76	62	48
1886.....	47	53	50	60	80	80	89	86	78	69	47	49
1887.....	46	44	60	70	81	81	87	86	78	77	62	42
1888.....	50	51	57	72	76	84	89	86	(†)	.....	.....	.....

\* Observations began August 1, 1885. † Station closed September 15, 1883.

FORT LARAMIE, CONVERSE COUNTY, WYO.

[Lat., 42° 14'; long., 104° 25'; elevation, 4,519 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*65
1886.....	52	65	66	.....	94	.....	.....	.....	.....	82	60	61
1887.....	60	61	73	83	90	97	98	95	87	86	72	51
1888.....	68	64	71	84	84	100	103	94	89	77	69	63
1889.....	51	54	71	82	83	100	(†)	.....	.....	.....	.....	.....

\* Observations began December 12, 1885. † Station closed June 30, 1889.

FORT MCKINNEY, JOHNSON COUNTY, WYO.

[Lat., 44° 23'; long., 106° 46'; elevation, 5,000 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1887.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*55
1888.....	60	58	63	77	72	90	95	88	88	77	60	68
1889.....	52	58	64	72	77	93	95	93	84	84	68	59
1890.....	57	66	68	80	86	86	97	92	84	71	69	68
1891.....	58	54	60	80	85	82	84	89	85	73	74	.....

\* Observations began Dec. 1, 1887.

FORT WASHAKIE, FREMONT COUNTY, WYO.

[Lat., 43° 01'; long., 108° 54'; elevation, 5,580 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1888.....	*49	55	62	76	80	91	99	88	85	69	60	52
1889.....	44	47	63	74	81	90	93	92	80	81	54	53
1890.....	43	60	60	72	80	84	93	91	83	71	69	57
1891.....	46	48	53	75	81	82	(†)	.....	.....	.....	.....	.....

\* Observations began January 1, 1883.

† Station closed June 30, 1891.



TABLE 3.—Record of annual minimum temperature (degrees Fahrenheit)—Continued.

## CHEYENNE, WYO.

[Lat., 41° 08'; long., 104° 48'; elevation, 6,105 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	—19	—12	3	19	22	35	45	40	34	14	16	—12
1886.....	—27	9	—16	4	22	40	46	44	25	22	.....	.....
1887.....	.....	.....	12	16	24	34	46	45	33	4	—12	—13
1888.....	—27	8	—5	25	27	37	45	40	30	16	7	2
1889.....	0	—16	15	22	24	31	38	42	28	22	1	6
1890.....	—2	—20	2	13	28	30	48	39	28	22	11	13
1891.....	—3	—7	—4	14	30	39	44	38	32	19	—4	.....

## FORT BRIDGER, WYO.

[Lat., 41° 28'; long., 110° 30'; elevation, 6,643 feet.]

1885.....	.....	.....	.....	.....	.....	.....	.....	*33	31	16	8	—3
1886.....	—11	6	—6	18	17	29	34	37	15	10	—13	6
1887.....	—15	—10	17	7	26	30	40	38	30	11	—2	—18
1888.....	—4	2	—2	26	27	34	38	40	(†)	.....	.....	.....

\* Observations began Aug. 1, 1886.

† Station closed September 15, 1888.

## FORT LARAMIE, CONVERSE COUNTY, WYO.

[Lat., 42° 14'; long., 104° 25'; elevation, 4,519 feet.]

1885.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*—19
1886.....	—33	6	—12	.....	24	.....	.....	.....	.....	22	—11	—10
1887.....	—25	—22	8	14	22	40	50	50	30	5	—34	—17
1888.....	—38	9	—10	22	27	41	49	44	29	27	—6	—13
1889.....	—9	—19	11	23	26	†29	.....	.....	.....	.....	.....	.....

\* Observations began December 1, 1885.

† Station closed June 30, 1891.

## FORT MCKINNEY, JOHNSON COUNTY, WYO.

[Lat., 44° 23'; long., 106° 46'; elevation, 5,000 feet.]

1887.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	—14
1888.....	—36	2	—17	23	29	33	48	42	35	19	2	2
1889.....	—6	—14	12	28	30	36	41	37	31	21	10	3
1890.....	—23	—22	6	13	37	30	51	44	22	28	7	5
1891.....	0	—25	—14	10	15	35	44	42	33	22	—14	.....

\* First observation December 1, 1887.

## FORT WASHAKIE.

[Lat., 43° 01'; long., 108° 54'; elevation, 5,589 feet.]

1888.....	*—42	2	—8	26	25	36	43	40	34	17	—3	—16
1889.....	—16	—21	7	22	27	33	41	36	27	23	6	—18
1890.....	—22	—24	—4	6	28	31	37	39	24	17	9	3
1891.....	—9	—28	—8	6	28	†33	.....	.....	.....	.....	.....	.....

\* Observation began January 12, 1883.

† Station closed June 30, 1891.



TABLE 4.—Record of mean daily range of temperature\* (Degrees Fahrenheit).

## CHEYENNE, WYO.

[Lat., 41° 8'; long., 104° 48'; elevation, 6,105 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	23.5	20.2	21.3	21.8	24.3	26.5	27.1	26.1	26.4	26.5	24.0	22.7
1886.....	23.3	23.4	22.5	22.7	34.3	29.1	31.2	26.3	29.4	26.4	.....	.....
1887.....	.....	.....	25.0	22.7	29.1	28.4	28.4	27.0	27.2	27.4	27.1	23.6
1888.....	27.2	21.8	25.7	26.8	23.8	29.4	28.7	27.6	32.2	26.4	21.2	21.8
1889.....	23.0	21.7	26.0	22.4	23.3	26.3	29.1	30.1	28.9	24.4	19.6	21.6
1890.....	23.5	21.5	19.7	21.4	25.7	31.2	28.5	26.6	30.8	23.2	23.6	21.1
1891.....	18.5	21.3	21.5	24.1	24.2	23.7	26.2	28.1	27.9	27.1	22.6	.....

\* The mean range of temperature is the difference between the average of the highest temperature for each day of the month and the average of the lowest temperatures for each day of the month.

## FORT BRIDGER, WYO.

[Lat., 41° 28'; long., 110° 30'; elevation, 6,643 feet.]

1885.....	.....	.....	.....	.....	.....	.....	.....	29.4	30.4	31.3	27.6	20.2
1886.....	20.0	20.7	20.9	21.1	30.6	31.0	33.7	29.1	31.9	25.7	17.8	18.1
1887.....	18.6	21.4	18.6	22.6	28.0	31.2	28.2	25.8	34.6	26.5	27.3	22.5
1888.....	24.6	20.0	21.9	25.0	23.5	28.6	31.6	30.6	(*)	.....	.....	.....
1889†	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

\* Station closed.

† September 15, 1888.

## FORT LARAMIE, WYO.

[Lat., 42° 14'; long., 104, 25'; elevation, 4,519 feet.]

1885.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(*)
1886.....	26.6	28.3	24.6	.....	36.1	.....	.....	.....	.....	33.9	19.5	28.4
1887.....	22.8	28.1	29.9	28.4	33.9	31.8	30.9	26.6	31.1	33.1	35.7	23.2
1888.....	30.5	28.4	28.5	35.4	26.1	33.7	35.9	31.2	36.9	32.7	26.4	28.0
1889.....	24.1	28.1	35.2	28.5	28.8	33.4	(†)	.....	.....	.....	.....	.....

\* Observations began December 1, 1885.

† Station closed June 30, 1889.

## FORT MCKINNEY, WYO.

[Lat., 44° 23'; long., 106° 46'; elevation, 5,000 feet.]

1887.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*22.0
1888.....	24.6	19.8	20.1	21.6	17.3	19.0	21.1	18.7	23.1	20.2	18.7	18.9
1889.....	20.8	21.0	20.5	20.8	22.1	22.6	23.9	25.1	23.3	19.3	19.4	25.0
1890.....	23.7	23.7	19.8	23.0	23.3	23.7	25.2	22.5	23.7	20.0	21.1	21.5
1891.....	18.9	25.7	21.2	21.0	22.1	20.5	22.4	23.4	23.1	20.7	20.0	.....

\* Observations began December 1, 1887.

## FORT WASHAKIE, WYO.

[Lat., 43° 01'; long., 108° 54'; elevation, 5,580 feet.]

1888.....	*25.2	22.1	22.7	22.0	23.8	30.4	31.6	30.2	34.0	27.3	23.0	26.6
1889.....	27.5	27.9	28.2	25.5	26.5	28.9	33.1	34.0	32.5	25.4	23.7	20.6
1890.....	25.2	20.8	26.9	27.7	28.8	30.5	33.8	31.3	33.3	25.9	25.7	26.2
1891.....	23.5	24.2	24.8	23.5	25.1	26.9	(†)	.....	.....	.....	.....	.....

\* Observations began January 1, 1888.

† Station closed June 30, 1891.

TABLE 5.—*Mean temperature for each of the seasons and for the year.*

Station.	County.	Elevation.	Length of observation.	Mean temperature.				
				Spring.	Summer.	Autumn.	Winter.	Year.
		<i>Feet.</i>	<i>Y. M.</i>	<i>Degrees.</i>	<i>Degrees.</i>	<i>Degrees.</i>	<i>Degrees.</i>	<i>Degrees.</i>
Camp Pilot Butte.....			2 0	44.4	66.7	42.1	19.5	43.2
Cheyenne.....	Laramie.....	6,105	2 0	43.0	64.7	43.6	29.0	45.1
Fort Bridger.....	Uinta.....	6,643	1 9	43.3	62.0	41.3	20.1	41.7
Fort D. A. Russell.....	Laramie.....	6,000	2 0	42.2	65.1	44.4	25.6	44.3
Fort Laramie.....	do.....	4,519	2 0	47.2	69.5	47.4	28.6	48.2
Fort McKinney.....	Johnson.....	5,000	4 0	43.9	66.3	47.7	26.7	46.2
Fort Sanders.....	Laramie.....	7,180						
Fort Sheridan.....	Yellowstone Park.....		3 0	41.3	60.3	41.3	19.2	40.5
Fort Stambaugh.....	Fremont.....	8,012						
Fort Washakie.....	do.....	5,580	2 11	43.1	64.9	43.7	20.5	43.0
Lusk.....	Converse.....		2 0	44.3	67.2	44.4	24.5	45.1
Average.....				43.6	65.2	44.0	23.7	44.1

## PROPORTION OF DAYS AND HOURS OF SUNSHINE.

One other peculiarity of the Wyoming climate is the exceptionally high percentage of actual sunshine as compared with the hours of day, or, in other words, the hours of possible sunshine. A clear, bright sky is the rule. Clouds only now and then obscure the sun, and when they do appear they are floating. The practical value of this maximum of sunshine is not confined to man, with its marked influence upon health and buoyancy of spirits, nor indeed to the herds and flocks of the farmer, but is also noticeable in the vegetable kingdom, especially in crops watered by irrigation; which, being duly supplied with moisture, are stimulated to a more rapid, larger, and more healthy growth by continuous play of the sun's rays in all their intensity.

This very intensity of the sun's rays at an altitude of a mile and more above the sea level also deserves notice, as likewise does the marked difference between the temperature in the sun and in the shade. The greater intensity is of course due both to the thinness, dryness, and hence clearness of the atmosphere, and the less distance the sun's rays have to traverse that medium in reaching the earth itself. The difference of temperature in sunshine and shade is due to this same extraordinary intensity in the clear sunlight on the one hand, and to all the combined influences tending to coolness at such an altitude and in so thin, light, and dry an atmosphere where the sun's rays are so obstructed as to result in a dense shade. It is a difference corresponding to that between day and night noted by all who have ever enjoyed the delicious coolness of a summer's night in the mountain region. Note the following examples offered by Mr. Elwood Mead, State engineer for Wyoming:

Station.	Elevation.	In the sun.	In the shade.	Difference.
	<i>Feet.</i>	°	°	°
Washington, D. C.....	80	75	52	23
Fort Collins, Colo.....	5,200	167	87	80
Mount Whitney, Calif.....	12,000	236	58.7	113.3

## RAINFALL.

In point of moisture Wyoming is at neither extreme, for while the total precipitation is but moderate it is sufficient to save the region from being arid in the desert sense, and the rainfall is so well distributed through the season that the soil is rarely parched, and never so literally dried and cracked as during the long rainless season in southern California and elsewhere. This will appear from the following tables, in which, it will be observed, there are almost no blanks for any single month in a period of several years—sixteen years for Cheyenne. Occasionally there comes a soaking rain, but the usual fall is so slight as to deserve the designation of gentle. As a consequence, the inhabitants escape the nuisance of dirty thoroughfares, and the plains, with now and then an off season, are kept fresh and beautiful throughout the summer, even to the time when it is essential to the curing of the grass for winter feed that the rains should cease.

Although there have been some very exceptional years, as for example in 1853, when the total rainfall at Laramie was 31.42 inches, in 1876, when it was but 5.03, and in 1883, when it was 19.24 at that place, still the precipitation is for the most part as uniform as that of almost any portion of the United States; giving a general average of something like 12 inches per annum for the agricultural areas.

TABLE 6.—*Record of annual total precipitation (in inches).*

## CHEYENNE, WYO.

[Lat., 41° 08'; long., 104° 48'; elevation, 6,105 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1875.....	.42	.06	.23	.50	1.20	.29	4.47	2.12	1.34	.60	.84	.03	12.10
1876.....	.02	.06	.54	.23	.50	.10	.79	.26	.00	.00	.32	.21	3.03
1877.....	.20	.14	.98	1.11	2.24	1.27	.43	.83	2.02	1.99	.17	.33	11.91
1878.....	.08	.13	1.16	.19	4.46	1.71	1.43	2.53	.75	.04	.00	.19	12.64
1879.....	.32	.20	.44	1.66	1.30	.07	1.04	1.26	.60	.65	.23	.17	.....
1880.....	.20	.09	.06	.17	.44	1.06	1.88	2.23	1.05	.76	.36	.08	.....
1881.....	.36	.22	.32	2.32	1.14	1.22	1.40	1.97	1.75	.88	.20	.01	.....
1882.....	.14	.05	.06	.46	2.73	1.85	2.30	.23	.35	.31	.06	.10	.....
1883.....	.88	.25	.85	2.76	3.68	3.67	1.45	2.18	.90	1.66	.16	.80	.....
1884.....	.76	.26	1.59	1.33	4.83	1.50	.60	2.07	1.25	.50	.18	.67	.....
1885.....	.16	1.31	.51	3.76	1.33	2.75	1.92	2.14	.69	.28	1.11	.16	.....
1886.....	.52	.84	1.36	1.14	.32	1.52	.71	1.61	1.05	.37	.....	.....	.....
1887.....	.....	.....	.14	2.20	.94	.80	2.71	1.90	1.25	.49	.29	.35	.....
1888.....	.29	.72	2.04	.94	3.74	.56	2.31	1.15	1.66	.30	.59	.21	14.51
1889.....	.23	.62	.26	1.24	2.85	3.67	1.23	.71	.54	2.58	.56	.16	14.65
1890.....	.16	.59	.17	3.93	.81	.65	3.64	3.18	T.	.76	.47	.11	14.46
1891.....	2.03	.89	1.61	1.18	4.72	1.84	.82	2.16	2.09	.25	.82	.....	.....

## FORT BRIDGER, WYO.

[Lat., 41° 28'; long., 110° 30'; elevation, 6,643 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1885.....	.....	.....	.82	.....	.....	.....	.....	*1.46	.99	.38	†.43	.41	.....
1886.....	.56	.43	.82	1.24	.20	1.16	.12	1.17	.06	.93	1.29	.32	.....
1887.....	1.44	1.24	.33	.37	.71	.16	.58	2.21	.41	.48	.27	.70	.....
1888.....	.53	.53	1.66	.75	1.91	.26	.94	1.10	(?)	.....	.....	.....	.....

\* Observations began Aug. 1, 1885.

† Station closed Sept. 15, 1888.

† 19 days.

TABLE 6.—*Record of annual total precipitation (in inches)—Continued.*

## FORT LARAMIE, WYO.

[Lat., 42° 14'; long., 104° 25'; elevation, 4,519.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	An- nual.
1885													
1886	.24	.28	1.20		.16					.35	3.23	*.01	
1887	1.19	.26	.30	1.46	2.02	.98	3.36	2.11	1.05	.38	.14	.20	
1888	.19	1.05	.76	.30	4.21	.09	2.94	4.52	.08	.26	.81	.44	
1889	.43	9.60	.53	1.31	2.26	12.28							

\* Observations began Dec. 1, 1885.

† Station closed June 30, 1889.

## FORT MCKINNEY, WYO.

[Lat., 44° 23'; long., 106° 46'; elevation, 5,000 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	An- nual.
1887													
1888	.15	.59	1.02	.73	6.82	2.14	2.89	3.51	T	.05	.23	.29	*.25
1889	.41	.81	.13	.41	.79	1.49	.59	.14	.17	.89	.34	.02	
1890	.15	.59	.86	.76	1.83	1.14	.88	.88	.01	1.20	.65	.03	
1891	1.31	.05	1.06	1.13	2.08	4.14	1.19	.78	.68	.59	.77		

\* Observations began December 1, 1887.

## FORT WASHAKIE, WYO.

[Lat., 43° 01'; long., 108° 54'; elevation, 5,580.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	An- nual.
1888	*1.02	.94	1.92	.64	4.57	.34	.87	1.94	.32	.38	.26	.11	
1889	.75	.25	.06	1.53	.55	2.60	.31	.31	.14	.87	.71	.62	
1890	.97	.31	.74	.64	.46	.44	.97	.73	.40	1.82	.26	T.	
1891	1.91	.18	3.58	2.23	4.58	† 1.30							

\* Observations began January 1, 1888.

† Station closed June 30, 1891.

TABLE 7.—*Mean precipitation for the seasons and the year.*

Station.	County.	Eleva- tion.	Length of ob- serva- tion.	Mean precipitation.				
				Spring.	Sum- mer.	An- tumn.	Winter.	Year.
		<i>Feet.</i>	<i>H. M.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Camp Pilot Butte			2 0	1.50	.63	1.28	2.35	5.76
Carter	Uinta	6,530	1 0	3.50	.80	1.95	2.40	8.65
Cheyenne	Laramie	6,105	19 8	4.16	4.59	2.08	.82	11.65
Edson	Carbon		3 0	4.27	2.07	3.13	1.84	11.31
Fort Bridger	Uinta	6,643	32 2	2.78	1.89	1.84	1.92	8.43
Fort D. A. Russell	Laramie	6,000	2 0	7.90	6.82	3.00	.87	18.59
Fort Fetterman	Converse	4,973	12 3	2.49	5.43	3.97	3.17	15.06
Fort Fred Steele	Carbon	6,850	12 6	3.93	2.39	2.52	2.19	11.03
Fort Laramie	Laramie	4,519	24 10	2.28	4.38	3.96	2.22	12.84
Fort McKinney	Johnson	5,000	4 0	1.23	3.99	4.66	1.30	11.18
Fort Sanders	Laramie	7,180	9 5	3.24	5.01	2.65	2.02	12.92
Fort Sheridan	Yellowstone Park		2 0	5.51	2.76	3.21	13.05	24.53
Fort Stambaugh	Fremont	8,012	3 10	5.40	1.13	2.25	2.02	10.80
Fort Washakie	do	5,580	12 0	4.79	1.97	1.32	1.32	9.40
Hat Creek	Laramie		3 0	6.47	3.90	4.58	.27	15.22
Lusk	Converse		2 0	5.85	3.21	.73	1.03	10.82
Average				4.08	3.19	2.70	2.42	12.39



## PREVAILING WINDS—DIRECTION, VELOCITY.

The direction from which the wind usually blows is of interest as indicating its character as to dryness or otherwise when the geography and topography of the region are well understood.

Referring to the observations at Cheyenne, it will be seen that the prevailing winds are from the north and northwest. Being a result of the overflow from the far west through South Pass and the valleys of the Sweetwater and North Platte, and of currents from the Pacific around the head of the Big Horn Mountains, these winds are more temperate than the direction would of itself indicate.

At Fort McKinney, some 250 miles north of Cheyenne, and exposed to the same winds by deflection of the Pacific currents, the prevailing direction is of course the same. But at Fort Laramie, in the valley of the North Platte and at the eastern extremity of the great east and west trough formed by the Platte and Sweetwater valleys the prevailing directions are east and west, as might be expected. So likewise the winds at Fort Bridger are from the west and southwest, and those at Fort Washakie from the southwest.

TABLE 8.—*Prevailing direction of wind.\**

## CHEYENNE, WYO.

[Lat., 41° 08'; long., 104° 48'; elevation, 6,105 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	NW.	NW.	NW.	NW.	NW.	S.	NW.	NW.	NW.	NW.	NW.	NW.
1886.....	NW.	NW.	NW.	S.	NW.	S.	S.	NW.	NW.	NW.	NW.	NW.
1887.....	NW.	NW.	NW.	NW.	NW.	S.	S. & N.	S.	NW.	NW.	NW.	NW.
1888.....	NW.	NW.	NW.	NW.	N.	S.	NW.	N.	NW.	NW.	W. & NW.	NW.
1889.....	NW.	N.	NW.	N.	NW.	NW.	NW.	NW.	NW.	NW.	NW.	NW.
1890.....	W.	W.	NW.	NW.	NW.	NW.	NW.	NW.	NW.	NW.	NW.	NW.
1891.....	NW.	W.	NW.	NW.	NW.	S.	S.	NW.	NW.	NW.	NW.	.....

\* From tridaily observations 1885 to June 30, 1888, thereafter twice daily.

## FORT LARAMIE, WYO.\*

[Lat., 42° 14'; long., 104° 25'; elevation, 4,519 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885*												†W.
1886.....	E.	W.	W.		E.					SW.	W.	W.
1887.....	W.	W.	W.	N. & E.	E.	E.	E.	SE.	E. & N.	N.	W.	W.
1888.....	W.	W.	W.	NW.	N.	W.	E.	N & SE	W.	W.	W.	W.
1889.....	W.	W.	E.	W.	W.	W.	(‡)					

\* Computed from one observation a day at sunset.

† Observations began December 1, 1885.

‡ Station closed June 30, 1889.

## FORT MCKINNEY, WYO.

[Lat., 44° 23'; long., 106° 46'; elevation, 5,000 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1887.....												*W.
1888.....	W.	NW.	NW.	W.	NW.	NW.	NW.	NW.	W.	W.	W.	W.
1889.....	W.	NW.	NW.	NW.	N.	N.	NW.	W.	NW.	W.	W.	W.
1890.....	W.	NW.	NW.	N.	NW.	N.	N.	NW.	NW.	W.	W.	W.
1891.....	W.	N.	N.	N.	N.	N.	N.	N.	N.	W.	N.	.....

\* Observations began December 1, 1887.

TABLE 8.—*Prevailing direction of wind*—Continued.

## FORT BRIDGER, WYO.

[Lat., 41° 8'; long., 110° 30'; elevation, 6,643 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....								*SW.	SW.	SW.	SW.	SW.
1886.....	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.
1887.....	SW.	SW.	W.	W.	W.	W.	W.	W.	W.	W.	E.	W.
1888†.....	SW.	W.	W.	W.	W.	W.	W.	W.	(f)			

\* Observations began August 1, 1861.

† Station closed September 15, 1888.

## FORT WASHAKIE, WYO.

[Lat., 43° 01'; long., 108° 54'; elevation, 5,580 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1888.....	*SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.
1889.....	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.
1890.....	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.	SW.
1891.....	SW.	SW.	SW.	SW.	W.	W.	(f)					

\* Observations began January 1, 1888.

† Station closed June 30, 1891.

The velocity of winds in an elevated region like that of Wyoming, where, owing to the comparative lightness of the atmosphere, they exert but slight mechanical force, is here noted more as a means of making the meteorological showing complete than because of any great significance from an agricultural point of view. It is not without its relation to the subject under consideration, however, as they will readily agree who dwell in those regions where not only grain crops but orchards and forests are prostrated now and then by heavy windstorms.

TABLE 9.—*Average hourly velocity of wind.*

## CHEYENNE, WYO.

[Lat., 41° 08'; long., 104° 48'; elevation, 6,105 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....	14.7	13.9	11.6	10.7	9.3	11.5	8.8	8.1	10.0	9.8	11.6	14.1
1886.....	13.7	13.5	12.7	11.8	8.4	8.0	7.3	6.5	7.1	9.7	(*)	(*)
1887.....	(*)	(*)	12.1	12.0	11.1	10.8	8.5	8.9	10.2	10.5	10.6	13.2
1888.....	13.1	12.9	11.9	12.0	10.7	12.0	10.0	8.7	8.1	9.8	8.9	10.2
1889.....	11.2	13.7	10.1	11.7	11.2	9.3	9.3	7.2	10.8	8.8	11.5	9.8
1890.....	12.8	13.6	15.0	9.4	11.0	9.2	9.3	9.0	9.9	12.3	10.2	12.9
1891.....	11.7	13.3	12.3	11.9	10.5	10.7	9.5	7.9	8.6	8.6	11.1	.....

\* No record.

## FORT BRIDGER, WYO.

[Lat., 41° 28'; long., 110° 30'; elevation, 6,643 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1885.....								* 4.6	7.3	7.6	4.1	81.0
1886.....	12.6	10.9	11.0	10.4	8.5	7.3	6.7	6.3	9.3	7.0	11.2	13.0
1887.....	18.8	9.7	11.2	11.6	9.5	9.5	6.1	7.2	7.5	10.2	7.1	10.7
1888.....	9.5	11.7	10.7	6.8	8.1	9.3	4.7	5.5	(f)			

\* Observations began August 1, 1885.

† Station closed September 15, 1888.

TABLE 9.—Average hourly velocity of wind—Continued.

## FORT MCKINNEY, WYO.

[Lat., 44° 23'; long., 106° 46'; elevation, 5,000 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1887.....												*8.6
1888.....	6.0	9.7	10.4	10.4	9.5	10.6	8.6	8.0	8.0	9.2	7.9	6.6
1889.....	8.0	11.9	8.9	10.7	11.6	10.3	11.6	8.2	11.1	9.5	8.8	9.3
1890.....	8.0	9.3	7.9	7.8	9.4	9.2	11.0	9.3	11.0	9.2	9.5	7.4
1891.....	7.8	8.1	10.2	11.6	11.3	8.9	8.8	8.8	9.9	8.5	8.7	.....

\*Observations began December 1, 1887.

## FORT WASHAKIE, WYO.

[Lat., 43° 01'; long., 108° 54'; elevation, 5,580 feet.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1888.....	*2.1	7.1	4.9	6.5	6.6	7.6	5.9	5.4	5.1	5.9	4.1	3.8
1889.....	3.8	4.9	5.7	6.1	5.4	5.6	6.7	5.6	5.9	4.3	4.1	5.3
1890.....	4.3	7.4	8.4	7.2	7.2	7.6	6.5	5.5	5.2	5.1	4.0	4.7
1891.....	3.9	5.9	5.6	6.0	5.9	5.9	(†)	.....	.....	.....	.....	.....

\*Observations began January 1, 1888.

†Station closed June 30, 1891.

## DISTRIBUTION OF PRODUCTIVE AREAS.

Speaking broadly, there are but very limited areas in Wyoming to be classed as nonproductive. There are no vast sandy plains, alkaline flats, or other lands wholly barren. Even in the poorest sections, rendered comparatively unproductive by excess of either sand or alkali, there is grass enough to afford a very considerable supply for stock; such amount in some of them as, with the protection afforded by hills and hillocks, renders them favorite resorts for cattle during the severer portions of the winter season. The mountain areas, except where the growth of timber is very dense, are grazing grounds of no little value. In general terms, all sections are productive of something useful for man or beast.

## AGRICULTURAL LANDS.

Agricultural lands, properly so called, are such as are or may be made available for the production of food or fiber for man's advantage. In those parts of the world where the precipitation of moisture from the atmosphere is sufficient to meet the demands of growing crops, all lands except barren sands, rocky wastes, and marshes, or swamps and swales that can not be drained, are in some measure capable of producing crops, and are therefore agricultural. But the same is not true of lands in the arid region where the rainfall is insufficient for this result, and where, accordingly, artificial watering becomes a necessity. In every such region the agricultural lands are only a fraction of the whole area, large or small in proportion to the amount of water available for their reclamation.

It is hardly necessary to say that Wyoming belongs to the last-mentioned class, as does half the rest of the agricultural world. There are considerable areas in the lower portions of the State, especially in sheltered localities, where quite good crops are sometimes, perhaps commonly, produced without the artificial application of water. In the lower Platte Valley, bordering on Nebraska; in localities in northeastern Wyoming, in the neighborhood of the Black Hills; in portions of Johnson and Sheridan counties east of the Big Horn Range, where the altitude falls below 4,000 feet; in places in the Wind River Valley, in Fremont County, as well as in the lower valley of the Bear in Uinta County, and in some other districts, the writer has seen very good yields of the tame grasses, alfalfa, oats, and root crops that were grown without irrigation. But in nearly, if not all, these cases the element of uncertainty was regarded as important. Moreover, it was conceded that the yield would ordinarily have been much greater had water been applied.

One of the most interesting of these examples is that of the tablelands in the vicinity of Newcastle, Weston County, at an elevation of about 5,000, feet upon which all the ordinary farm crops are grown with fair success except in seasons very unusually dry. But even there the proprietors would deem it an object to irrigate, if that were possible, because of the greater yield as well as greater certainty of the crop.

Notwithstanding these partial successes without the help of irrigation, practically speaking they but serve to prove the rule and to justify the general statement that agricultural lands in Wyoming are such as can be brought under water at will.

As heretofore remarked, the total area of irrigable lands is in the neighborhood of 10,000,000 acres—greater than the combined areas of Delaware, New Jersey, and Connecticut. They have an altitude ranging from 3,500 to 7,500 feet, with a corresponding adaptability to the various agricultural products of the northern latitudes, some being suited to the production of corn, the semi-hardy vegetables and fruits, while all furnish the conditions essential to the growth of the tame grasses suitable for hay.

In making an agricultural map of Wyoming one need but show the water courses and put his color broadly upon such expanses of the valleys and accessible plains contiguous as are found on so many of the streams. When completed it would present to the eye four great divisions, corresponding to the points of the compass, namely, such as are watered by the four principal rivers of the State and their tributaries—the North Platte, in the southeastern portion; the Powder and a number of lesser streams watering the northeastern; the Big Horn, with its many affluents, including the Wind, in the northwest; and the Green, supplemented by the Bear and Salt and Snake, in the southwest.

These several divisions are of nearly equal importance as to the



amount of agricultural land they embrace, nor are they very unequal in their value, although it is to be said of the northeastern that it has a lower average altitude than either of the others. A few words descriptive of them may be introduced for the general information of interested parties not familiar with the State.

Southeastern Wyoming may be designated as the Platte division. Besides the very considerable valleys of the North Platte, east, west, and north of the Laramie Range, and the beautiful valleys of the Laramies, the Medicine Bow, and the Sweetwater, all of them entitled to be called rivers, this division also includes the fruitful valleys of a multitude of little streams; the altitude of the whole region ranging from 4,600 to 7,500 feet.

The Lower Platte, in Wyoming, has a rather deep channel and so slight a fall that irrigating canals require to be deep and expensive. Moreover, for considerable distances the breadth of desirable valley lands is hardly sufficient to justify the requisite expenditure. But the branches of that river, not only such as have their sources in the Laramie Range and flow eastward, but also the Laramies and the Sweetwater, are more rapid and command extended areas of land highly fertile as well as smooth and beautiful; their only drawback being their high altitude (6,500 to 8,000 feet), with a consequent partial limitation of their availability for some kinds of crops, especially the more tender vegetables and fruits. The aggregate area of irrigable land in this division is very great. Tracts of 50,000 to 250,000 each have been noted for improvement by means of single great canals.

The Powder River division covers not only the drainage of the eastern slope of the Big Horn Mountains, but also of the Wolf Mountains and Black Hills. As it includes not only the Powder, but also the Cheyenne, Belle Fourche, and Tongue rivers, its lands, as before remarked, have a lower altitude than others in the State, varying from 3,500 to 5,500 feet, and its streams with their sources in the snowy Big Horn range have a quite regular flow. It is here accordingly that the lands suited to agriculture have received special attention. Johnson and Sheridan counties are especially known in Wyoming as agricultural counties. If the streams are not so large as to command vast areas, some of them do command tracts of 50,000 to 75,000 acres irrigable by a single ditch, and they have all those compensating advantages which are implied by a longer season and milder climate.

The Big Horn division in like manner takes its name from the important river which traverses it from south to north in its flow toward the Yellowstone in Montana, drawing off the waters which have their sources in those three elevated ranges of mountains, the Wind on the south, the Shoshones or Absarakas on the west, and the Big Horn on the east. Having an altitude of but 4,000 to 6,000 feet, with fertile soils for the most part, it must become one of the most important in the State. The valleys of the Big Horn and of the Wind are in places quite

broad, affording opportunities for extensive operations in irrigation, with tracts of 100,000 to 200,000 acres that may be watered by one canal. But independent of these, and more important, too, are the many narrower valleys of the great number of small rivers and creeks so easily utilized by the individual farmer or farming community. The streams rising in the Shoshone range and flowing eastward all have considerable bodies of excellent land available for agriculture. One of these on the Gray Bull, embracing 170,000 acres, is to be improved by means of a ditch already surveyed; the Little Wind, with several tributaries, still more. The valley of the two Winds at and above their confluence has a considerable area of lands particularly smooth and fertile, which can be easily covered; while on the upper Little Wind and the branches of the Popo Agie lies the broad and beautiful Lander Valley, long noted for its fertility and successful cultivation.

It is in the midst of this division, the southern half of it, that lies the Government reservation assigned to the Shoshone and Arapaho Indians. And a magnificent reservation it is, with its many picturesque landscapes, traversed by its several streams, fringed with timber, dotted with sparkling lakes, and overlooked by the majestic mountains of the Wind River range. It is necessary that the Government should keep faith with the red men, whose villages were planted there by its order, and whose small herds of cattle and ponies freely range over it, but it is hardly likely that the whole of this area will always continue to be the uncoveted heritage of the 2,300 Indians who at present occupy it.

The Green River division, embracing not only the lands in southwestern Wyoming, which are supplied by the river of that name, but also those watered by the Snake and the Bear, has like important resources. In the valley of the upper Green there are some quite extensive tracts of farming lands which are destined to be improved at no distant day. Their economical watering will require considerable investments of capital, but the area and quality are such as to justify it. The same is not true, however, of the many valleys of the smaller streams tributary to the Green, whose lands are easily reached by inexpensive ditches. Nor is it true of the valley of the Snake, with its great number of branches, most of them with a considerable fall on their way from the heights of the Wind, Gros Ventre, Teton, Snake, Salt, and Sublette ranges of mountains; nor yet true of the Bear River Valley, in the extreme southwest corner of the State. In all these excellent lands are easily brought under water. The altitude of this division is not far from 7,000 feet.

Touching the amount of irrigable land in this division, it is very great. Something like 100,000 acres will soon be brought under ditches from Blacks Fork alone, and one of the surveys lately completed in the valley of the Green looks to the watering of 300,000 acres.

## PASTURE LANDS.

The pasture lands, distinctively considered, are those broad expanses of upland usually called plains or plateaus. In portions of the State they are as smooth as shorn meadows; in others they are sprinkled here and there with patches of sagebrush, but everywhere yielding nutritious grasses suited to the different altitudes and localities, the whole number of species being over 100, but so limited, the most of them, in their habitat as scarcely to deserve mention in a practical paper.

It is needless to say that in a region where agriculture depends on irrigation, and is confined to the valleys of streams and such adjacent lands as may be watered by means of ditches and canals, the great body of lands, exclusive of mountain ranges, is to be assigned to the class now under consideration. The pasture lands of Wyoming are found in all sections. If we allow 15,000,000 acres for mountain areas more or less covered with timber, and hence properly enough treated as forest, and some 10,000,000 acres of irrigable lands and hence to be classed as agricultural, all the remainder, or nearly 40,000,000 acres, may be regarded as pasture. Indeed, a very considerable proportion of the forest areas may also be included, since, except where the growth of timber is very dense, the grazing is such as to make portions of those areas favorite resorts for all kinds of domestic animals, as they have been during an unknown period for herds of elk, deer, antelope, and mountain sheep.

It is hardly necessary, after what has been said, to point out how remarkably the whole State of Wyoming is watered, so that there are almost no portions of it wholly unavailable for grazing purposes because of their distance from water courses. The map itself will make this apparent at a glance. It shows, likewise, that the vaster bodies of pasture are found in the southeastern portions of the State, watered by the North Platte and its tributaries; the northern portions, supplied by the Powder, the Belle Fourche, the forks of the Cheyenne, and the headwaters of the Tongue; that most elevated of considerable plateaus, the beautiful and magnificent Laramie Plains, with their extent of some 25 to 30 by 50 and more miles; the southwestern portion, watered by Green River, the Bear, and the Salt; and the northwestern division, shut in by the Wind River, Big Horn, and Shoshone ranges of mountains, and so beautifully supplied by the Wind rivers (Big and Little) and the Big Horn, with its numerous branches.

Of the great number of grasses growing natively in Wyoming the following are more especially deserving of notice:

The most valuable of such as grow along streams and in moist mountain basins are varieties of timothy, blue-stem, and bent-grass.

The bent-grass referred to is the species known as the *Agrostis grandis*. It grows along the rich, moist banks of streams in the mountain region



and makes excellent feed. The *Druxia* is also a bent-grass (usually known as reed-bent), but it prefers bench lands, where it has a corresponding value.

The mountain timothy (*Alopecurus pratensis*, variety *alpestris*) occurs at elevations of 5,000 to 7,000 feet, and in rich soils along mountain streams, clothing those charming spots known as mountain meadows. It grows there to a height of 2 or 3 feet, with slender, leafy culm and with an oblong, hairy head resembling that of timothy, though shorter and thicker. "For the more elevated meadows of the Rocky Mountain region and for northern latitudes there is no grass which so highly recommends itself as this, both for hay and for summer grazing," says Prof. W. J. Beal, and this opinion has ample confirmation from those who are familiar with its use.

The Alpine timothy (*Phleum alpinum*), sometimes called "native" timothy, also closely resembles the cultivated timothy of the country, and is found in the mountain region near streams, with a range of altitude between 5,000 and 8,000 feet. It is not so tall as the species *pratense*, but has a stouter and more leafy growth and is highly valued whenever found.

The so-called blue-stem or blue-joint (*Agropyrum glaucum*) must also be mentioned in this connection as delighting in river-bottom localities, while also found on the drier bench lands. Its common name is derived from the very marked bluish tint of its stalks and leaves. Its yield is not so great as that of the timothy species, but no grass in the Rocky Mountain region is more highly prized.

Of the grasses suited to the bench lands of Wyoming, the "buffalo," "reed-bent," "June," and "bunch" species are perhaps the most important.

Botanists tell us that the so-called buffalo-grass is not the true species (the *Buchla*), but the *Boutelone olegostachya*, which, however, is no less valuable for grazing purposes. It more naturally belongs to the lower altitudes, under 5,000 feet, but is also found above that level. With strong perennial roots and curly leaves, it holds its ground where other grasses would be trodden out, and affords a large amount of feed much relished by stock of every species. The reed-bent is characterized by a like hardness, but is not so valuable in itself.

The "bunch" grasses are numerous, one large class belonging to the genus *Poa*, another to the genus *Festuca*. The Poas are found in all the more northern regions of the United States, having also a very wide range of altitude. Prof. Beal says of them:

Wherever grasses grow at all, from the seashore to the mountain top, from the Arctic zone to the Antarctic, this genus has its representatives. Even as far north as Wyoming and Montana *Poa universalis* ascends to the altitude of 9,000 feet. At this elevation it is dwarfed in habit, but lower down the mountain side it soon becomes taller and makes a valuable forage plant. Kentucky Blue-grass (*Poa pratensis*) is quite indigenous and grows along the streams and rivers. *Poa tenuifolia* may well be regarded as the grass of the country. No species so well stands the long

summer drought, and it constitutes the chief forage on the dry bench lands. It has several local names, such as "Bunch-grass," "Redtop," "Redtopped buffalo-grass," etc. In the drier soils the culms are low, less than a foot apart, and slender, usually of a reddish color, and the foliage is reduced to the short and dense radical tuft; but the plant responds readily to richer soils and better situations, and when growing along streams or on irrigated land it makes a luxuriant growth of foliage and attains the height of 2 or 3 feet. \* \* \* As fine a field of natural grasses as I have seen anywhere included *Poa tenuifolia*, *Kæleria cristata*, *Stipa viridula*, and *Stipa cornuta* as the leading species; the *Poa* being the most abundant.

The great bunch-grass or buffalo bunch-grass (*Festuca scabrella*) is also one of the most valuable of mountain grasses. It belongs especially to the mountain parks, slopes, and foothills, being particularly at home at elevations of 6,000 feet and over. It is rather coarse for sheep, but is first class for cattle and horses.

The June grass of the Rocky Mountain region is not the same as the grass known by that name at the east. It is *Kæleria cristata*, above-mentioned as being commonly found with the Poas. On the benches it is short, but fine and most excellent. Irrigation increases its growth and makes of it a desirable hay crop.

The grasses common to the dry and sandy hills are the "brown" and "feather," the former being of the *Andropogon* genus and the latter of the genus *Stipa*. The brown sedge, brown grass, or beard grass grows quite abundantly where other grasses will not grow at all, and is relished by stock. Of the feather (*Stipa*) genus the number of species is considerable, the *comata* and the *viridula* being the most prominent. The latter is the more valuable for its nutritive properties, but not so hardy as the *comata*, which flourishes even in soils too thin and gravelly for the hardiest of the Poas.

In conclusion, it is safe to say that there is no finer elevated grazing region in the world than that of Wyoming, in so far as the excellent character of its grasses is concerned. But of all this something more will be said later, under another head.

#### WATER AVAILABLE FOR AGRICULTURE.

As already remarked, the rainfall for the plains of the State is something less than 12 inches per annum. It varies from 8.50 to 17.26 for the term of twenty years or more during which observations have been recorded. If this were the sole dependence there could be no farming in any proper sense. But fortunately there are over 20,000,000 acres of mountain area, upon which the annual precipitation, according to the estimates of the State engineer, has an average of 30 inches, giving thus a total of something like 50,000,000 acre-feet for these grand watersheds of Wyoming. It is not possible to say just how much of this is lost by evaporation and by sinking away and reappearing outside the limits of the State through the medium of subterranean channels, but we have the authority of the State engineers of Wyoming and Colorado for estimating a saving of 40 per cent. Assuming, then, that the en-

gineers' estimate that the so-called duty of water, or requisite supply in inches, for Wyoming is 2 feet, it would appear that the total amount is sufficient to meet the demands of some 10,000,000 acres.

In practical agriculture some of this water will be lost; but, on the other hand, some of it, perhaps as much, will be used over and over again. Hence irrigation of this amount of land is at least theoretically possible, and the important query is, How far can this estimated supply be made actual?

#### DISTRIBUTION OF WATER.

It is manifest that the practical result must depend somewhat upon the distribution, for if the whole amount of 20,000,000 acre-feet of water were all gathered into and discharged through the channel of one mighty river, it would very certainly be impossible to make it reach and irrigate so great an area as 10,000,000 acres. But, fortunately, Wyoming not only enjoys a larger total of precipitation than any other State within the whole arid belt, but is also favored with a wider and more equal distribution. It is in all respects the best watered of the mountain States. This must have appeared incidentally from the mention of the four great streams, each with its numberless tributaries, in the four several agricultural divisions of the State above described; but no possible description could make it wholly appear. One must ride over it in every part in order to gain any just appreciation of how almost completely a network of waterways, large and small, covers the whole State. They are numbered by the thousand. There are, indeed, quite wide stretches of unwatered land in a few sections, but for the most part the traveler, in whatever direction, encounters running water at very short intervals.

Each of the great rivers has a large volume of water, the maximum discharge of the North Platte being 15,000 cubic feet per second; that of the Big Horn 25,000; that of the Green and Powder less, yet very considerable. Moreover, this maximum occurs at a time when water is most needed for irrigation.

In this way nature has brought the water and the richest of the lands into the closest relations and provided for many thousands of pleasant and productive valley farms.

Nor is this all; there is still another element of much importance to the future of Wyoming agriculture. If there were no possibility of storing the waters which flow during the non-irrigation season, its availability would of course be largely diminished by such waste. But here, too, Wyoming is fortunate in the great number of natural basins; reservoirs ready made or convertible into reservoirs with but little cost. Of these the number is so great that a comparatively small proportion of the water of streams need be wholly lost.



## IRRIGATION.

It has already been mentioned, incidentally, that about one-half the millions who inhabit the earth live in regions where irrigation is a necessary condition of agriculture. Moreover, the inquiry has gone beyond numbers, and shown that these millions are by no means at so great a disadvantage as would at first appear. For, although it requires a little more capital to inaugurate and carry on farming enterprises where artificial watering is necessary, this is more than offset by the following points of advantage, namely:

(1) A certainty of the requisite moisture just when and where desired, with consequent immunity from drought, and hence from a partial or total loss of crops.

(2) A constant fertilization by deposit of finely comminuted soil from the water thus spread over the surface, even as the wonderful valley of the Nile is made perpetually fruitful by the overflow of that river.

(3) A greatly increased yield, often two or three times that produced without irrigation.

(4) A better quality of product on account of the possibility of securing the most perfect development.

## THE BEGINNINGS OF IRRIGATION.

Small beginnings were made in a few localities many years ago, long before there was any thought of systematic work in agriculture or of legislative action in relation thereto. It was not with a view to the supply of any market; it was not farming at all in the usual sense, but a mere incident in the life of the stockman who wanted hay for winter feed as well as a home supply of roots and vegetables of his own growing. In some instances results were produced that surprised the ranchmen and encouraged others to like undertakings.

Messrs. Beckwith and Quinn, of Uinta County, had improved farms on Bear River, below Evanston, on which the ordinary crops were grown with success, and on which they had also produced fine crops of alfalfa, with cattle and horses of improved breeds for the consumption of their grass and grain. Later, or at about the same time, there were beginnings of like character in what is now Fremont County, more especially near Lander, in the valley of the Popoagie creeks, affluents of the Little Wind River; and soon after farming was inaugurated at one or two points in the southeastern portion of the State, as by Mr. Fee at Laramie, in the valley of the Laramie River; also, in middle-eastern Wyoming, as at Fort Fetterman, where Capt. Coates, then (between 1875 and 1880) in command, raised not only excellent oat crops, but made one of the finest gardens in the Western country.

At length, after the Sioux war, in 1876, that sharp struggle in which the gallant Custer lost his life, and the final opening of northeastern Wyoming to settlement, that entire beautiful region, embracing what

are now Johnson, Sheridan, Crook, and Weston counties, became the scene of those still more active agricultural operations which have since gained for it distinction.

These were the beginnings of a development which for the last few years has been somewhat rapid and important. It had become a recognized fact that the soils were exceedingly fertile and that nothing should be attempted without irrigation. Still, it was some time yet ere any considerable number of citizens, competent to take up and carry through any considerable irrigation enterprise, were ready to turn from so attractive and profitable a business as that of cattle-raising and enter this new field. It was not until a decline somewhat permanent, as it appeared, in the price of beef, coupled with a season or so of very heavy losses by the severity of winter, that stockmen were moved to look into the possible profits of a new industry. But, meanwhile, the wave of population had been moving westward. The West was becoming East, and the eye of not a few, including such as had experience in agriculture, was attracted by the farther West. From the long trains of movers, bent on gaining the promised land of Oregon and Washington Territory, some began to turn aside and pitch their tents in the beautiful valleys of Wyoming.

It was the view of men of capital and accustomed to large operations that the money to be made, if made at all, must be sought in the inauguration and successful management of large ditching enterprises—operations in which the sale of water could be coupled with the handling of lands enhanced in value by the improvements made. But there were serious hindrances in the way of all this. The facilities for acquiring title to public lands, while exceedingly liberal for the individual citizen, were wanting as to schemes for acquiring such amounts by any corporate body as would justify the large expenditures requisite to the construction of extensive irrigation works. Nevertheless, the laws were open to constructions which made it possible for corporate bodies to acquire the necessary amount by indirect methods, which, though questionable in the mind of some, were lawful in the view of others, because of their being at once necessary to successful work in irrigation and without legal prohibition. And accordingly they were for a time allowed to proceed without protest or interference. Indeed, they proceeded at a rapid pace, both in the hands of private parties and corporations. The land offices already established were thronged by applicants for land. New offices were demanded and were opened for the greater convenience of the public. Surveyors and engineers were actively at work in all directions locating entries and establishing lines for ditches and great canals. The air was full of large schemes. Great expectations were cherished by individuals, corporate bodies, and the whole people. Only the stockmen, who saw the streams on their magnificent ranges being captured one after another and long lines of wire fence building in every direction to shut in the valleys and shut out their



roaming herds, were troubled by the new order of things. And they—the most prudent of them—seeing that a change was inevitable, either drove their great herds across the line into neighboring territories not yet so considerably invaded or changed from the old style of stock-raising, when cattle by tens of thousands grazed where they would and took care of themselves, except at the round-up, to the new rule of smaller herds and better stock, with winter care, thus themselves becoming farmers in part. Some went still further, taking in hand important irrigation enterprises and making themselves leaders in the industrial revolution thus begun.

Perhaps the first step toward inaugurating the work of irrigation on a large scale was that of the Wyoming Development Company, in undertaking to reclaim a body of nearly 60,000 acres, forming the quadrangular tract between the Laramie River on the north, the foothills of the Laramie Range on the south, and Chugwater and Sabyllle creeks on the east and west, some 90 miles north of Cheyenne. The facts concerning this enterprise are so concisely set forth in a report of the company, made in 1887, that I quote the following:

The average altitude is about 4,800 feet above the sea level. The water for irrigating purposes is obtained from the Laramie River, which carries a large volume, and a plentiful supply can be depended upon. A tunnel 3,100 feet in length and 7 by 8 feet in diameter, with a fall of 2 feet in 100 for the first 400 feet and 1 foot in 100 for the remainder of its length, has been cut through solid rock, and conveys the water from the river to Blue-grass Creek, which flows into the Sybille River, and from there two main canals have been constructed along the higher elevations of the lands. From the main canals lateral ditches have been made, and from the latter sublaterals can be constructed, and by this means water is distributed over the whole area. Canal No. 1 is 34 miles in length, has a width of 25 feet on the bottom and a depth of 4 feet at the head gates. It has a carrying capacity of 427.56 cubic feet per second. Canal No. 2 is 22 miles in length, with a width of 20 feet on the bottom, and a depth of 3½ feet at the head gates, and a carrying capacity of 340.67 cubic feet of water per second. These irrigation works have been made in a thorough, substantial, and permanent manner from the plans prepared by Mr. E. S. Nettleton, State engineer for Colorado, and this company is protected in its perpetual rights to the water by the laws of the Territory.

The delay of practical operations by this company in consequence of some changes of policy in the General Land Office at Washington, and the inability of the company to acquire title to its lands, was not only a great damage to it, but a certain hindrance to the progress of irrigation elsewhere in Wyoming. Still the opportunities for acquiring considerable bodies of land in one name, and for the combination of owners in the appropriation of water, were such that the formation of companies continued. But the work went on in any and every sort of way, according to the knowledge, ignorance, or fancy of the individual or corporation undertaking it. The laws relating to the subject were crude and incomplete; there were no uniform standards of measurement; no regard, or very little, was paid to questions of priority or to the relation of claims to supply. Infinite confusion prevailed, and demands

of conflicting claimants were heard on every side. The law of 1886 creating eight water districts superintended by commissioners had done something, but irrigation was still in a crude state.

It was this condition of things that forced upon the public, and at length upon the legislature, the pressing need of better laws and of a thorough system resting on both science and experience; the same to be devised and supervised by an engineer of both competency and efficiency. Happily, the very man was near at hand in the person of Mr. Ellwood Mead, C. E., by whose advice legislation was duly framed, and under whose wise and vigorous management, first as Territorial and since as State engineer, so great things have been accomplished within the past five years.

This lack of competent and authoritative supervision so felt before his time, and even as late as 1889, could hardly be more clearly set forth than in the words of his second annual report, submitted to the governor November 30, of that year, as follows:

The most unfortunate feature, however, is the fact that the location and manner of construction of ditches has been left entirely to the inclination or financial resources of the settler. There has been no preliminary control of the streams, and the waters have been diverted in a haphazard fashion rather than in pursuance of a definite policy, having for its end their full utilization and economical distribution. As a consequence, while we have many works of an excellent character, leaving, in their admirable design and substantial construction, nothing to be desired, considered as a whole the result is still far from satisfactory. In many instances defective works make the utilization of the waters wasteful and expensive. In others, wrong locations and excessive appropriations make the proper supervision and control by the State extremely difficult and expensive. These evils will, in time, disappear, but they could almost wholly have been obviated by the exercise on the part of the Territory of an intelligent preliminary supervision over the location and construction of all irrigation works.

While the advantages of such supervision have long been apparent to all who are familiar with our situation, the reasons for delay in its being undertaken have been numerous and important; they are found in the character and previous training of the people and in the nature of our Territorial government. In the first place, our agricultural population are descendants of people inhabiting the most important humid districts on the globe, and whose whole previous training and inherited traditions led them to look with disfavor on any restrictions or control of the use of water. The inherited idea that water was public property, to be seized and used in any manner or at any place which inclination or profit might dictate, has probably had much to do with the delay in providing needed safeguards, as well as leading to the evasion and disregard of the laws already in existence.

There is every reason to believe that we are now at a turning point in the history of this interest, not only in this Territory but throughout the arid belt in which the unaided and, in many instances, misdirected efforts of individuals are to give way to works constructed according to systematic plans having for their object the economical distribution of water and the reclamation of the largest areas of land. We are fast coming to realize that agricultural values inhere in the water rather than in the land which it reclaims, and with this knowledge comes the conviction that more efficient supervision is required in its disposal and utilization.

## THE NEW ERA IN IRRIGATION.

Previous to the enactments providing for a Territorial engineer, provision had been made for the recording of ditches, but these records were scattered here and there and everywhere throughout the Territory and were unavailable. In the language of the report above cited, "several water commissioners had been appointed, but all were without proper information as to their duties. The rights of different claimants to water had only been determined as required by law in one instance."

The law creating the office of Territorial engineer defines his duties in the following terms:

SEC. 2. The Territorial engineer shall have general supervision of the direction and division of the water of the various natural streams in the Territory, and shall have supervision of the work of the water commissioners of the different districts of the Territory, and shall do and perform any and all work for the Territory which comes within the nature of his profession as an engineer when called upon by the governor so to do.

SEC. 3. The Territorial engineer shall make, or cause to be made, careful measurements and calculations of the maximum, minimum, and ordinary flow, in cubic feet per second of time, of the waters flowing in each stream from which water shall be drawn for irrigating purposes, commencing such work upon those streams most used for irrigating. He shall collect facts and make a report as to a system of reservoirs for the storage of water in those portions of the Territory where such a system is practicable, stating in such report the location, capacity, and cost of such reservoirs. He shall become conversant with the waterways of the Territory and the needs of the Territory as to irrigation matters, and in his report to the governor he shall make such suggestions as to the amendment of existing laws, or the enactment of new laws, as his information and experience may suggest; and he shall keep a full and proper record of his works, observations, and calculations, all of which shall be the property of the Territory.

Acting in pursuance of this law, the Territorial engineer soon began an important revolution in the whole business of irrigating by his systematic work and vigorous management, so inspiring new confidence and stimulating to new effort, that in 1889 not less than 600 streams had been tapped by ditches, the number of ditches recorded being 2,600, and of unrecorded 5,000, with a total mileage of 5,000 miles. Still, at that time the most important part remained to be done. The irrigation laws had indeed been "an evolution," the direction of which had been "largely affected by the lack of means on the part of the people to inaugurate a comprehensive system of control and by the desire to await the admission of the Territory to statehood before attempting to formulate a permanent code." The result had been of "a temporizing and fragmentary character, the aim being to provide for immediate necessities rather than anticipate future needs." In further comment the engineer, in his second report above referred to, adds:

That legislation should have been of this character was almost inevitable. The earlier years were seasons of heavy expenditure for the construction of ditches and provisions for the payment of land and its subsequent reclamation. With



heavy outlay and small returns there was a natural desire to limit the taxation for supervision to the smallest possible amount, but the important and unexpected extension of the irrigated territory has necessitated constant changes in laws to provide for the protection of rights and to meet the increasing complications. As a result, while the repeal of inadequate laws has resulted in some contradictions and some vital omissions, still, taking them as a whole, Wyoming has the most advanced and comprehensive water-right laws of any of the arid States or Territories.

In view of the great confusion and loss growing out of unwarranted claims, imperfect records, faulty constructions, conflict of rights, and judicial decrees incapable of execution, the engineer was finally moved to lay down the following as cardinal principles to be regarded in the settlement of water rights:

First. That as ditches must of necessity precede agriculture, the date of beginning ditch construction should be the date of priority for all land reclaimed within a certain period after the completion of the ditch, and this time should vary with the magnitude of the work and the difficulties of construction—that is, more time should be given for a ditch 10 miles long to water 10,000 acres than for a ditch 2 miles long to water a section.

Second. That the extent of grants should be limited to the reasonable requirements of the land and not measured by the capacity of the ditch.

Third. That there should be no ownership in water except by the State. The right to its use for any legitimate purpose should, however, be fully guaranteed and protected. In irrigation it should inhere in the land, the right to water for the same being made perpetual, so that water-rights may go with land titles.

The framing of a constitution for the coming State of Wyoming during the following year (1890) afforded an opportunity for putting these principles into the fundamental law as well as for requiring the legislature to enact the laws necessary to give them practical effect. And accordingly Article No. VIII of that instrument, entitled "Irrigation and water rights," embodied such principles and provisions in the following form:

SECTION 1. The water of all natural streams, springs, lakes, or other collections of still water within the boundaries of the State is hereby declared to be the property of the State.

SEC. 2. There shall be constituted a board of control, to be composed of the State engineer and superintendents of the water divisions, which shall, under such regulations as may be prescribed by law, have the supervision of the waters of the State and of their appropriation, distribution, and diversion, and of the various officers connected therewith; its decisions to be subject to review by the courts of the State.

SEC. 3. Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests.

SEC. 4. The legislature shall by law divide the State into four water divisions and provide for the appointment of superintendents thereof.

SEC. 5. There shall be a State engineer, who shall be appointed by the governor of the State and confirmed by the senate; he shall hold his office for a term of six years, or until his successor shall have been appointed and shall have qualified. He shall be president of the board of control and shall have general supervision of the waters of the State and of the officers connected with their distribution. No person shall be appointed to this position who has not such theoretical knowledge and practical experience and skill as shall fit him for the position.

In pursuance of laws enacted in obedience to these provisions of the State constitution, the "four water divisions" required to be formed are those already referred to, under the head of agricultural lands, as natural divisions, having been determined by the drainage lines of the State. In the language of the State engineer—

Division No. 1 comprises the North Platte River and all tributaries of the North and South Platte rivers within the State.

Division No. 2 comprises all tributaries of the Missouri and Yellowstone rivers north of the North Platte River and tributaries east of the Big Horn Mountains.

Division No. 3 comprises Big Horn River and its tributaries.

Division No. 4 comprises Snake, Bear, and Green rivers and their tributaries.

Each of these divisions is presided over by a member of the board of control as superintendent under the president of the board as State engineer.

For the more immediate supervision and management of irrigation, the law approved December 22, 1890, provides that the board of control shall divide the State into water districts, so formed and constituted as to secure the best protection to claimants for water and the most economical supervision on the part of the State; such districts to be created from time to time as may be necessary, and to be, each of them, under a water commissioner appointed by the governor for the term of two years, with a compensation of \$5 for each day actively employed in the duties of his office, and with power to appoint competent assistants for a number of days, not exceeding thirty-five in any one year. The general duties and powers of the commissioners are thus defined by section 42 of the law:

SEC. 42. It shall be the duty of said water commissioner to divide the water in the natural stream or streams of his district among the several ditches taking water therefrom according to the prior rights of each, respectively, in whole or in part, and to shut and fasten, or cause to be shut and fastened, under the direction of the superintendent of his water division, the head gates of ditches heading in any of the natural streams of the district when in times of scarcity it is necessary so to do by reason of the priority of rights of those taking water from the same stream or its tributaries. Every person who shall willfully open, close, change, or interfere with any head gate or water box without authority shall be deemed guilty of a misdemeanor, and on conviction thereof shall be fined a sum not exceeding one hundred dollars, or be imprisoned in the county jail for a term not to exceed six months, or by both such fine and imprisonment. The water commissioners, or their assistants, within their districts shall have power to arrest any person or persons offending and turn them over to the sheriff of the proper county, and immediately upon delivering any such person so arrested into the custody of the sheriff it shall be the duty of the water commissioner making such arrest to immediately in writing, and upon oath, make complaint before the proper justice of the peace against the person so arrested.

The head gate, by which the water can be turned on or off, as well as the flume or weir for measuring the water in the ditch, are to be maintained by the appropriation, and all dams over 5 feet for raising and diverting water must be approved by the State engineer.

In case of question as to rights, the board of control can fix a date for examining into the respective rights of all persons using water from

any stream; and knowing first the amount of water available (previously determined by the State engineer) as well as the area of land irrigated, or susceptible of being watered, can make the proper order as to the right of each claimant, under the rule that none shall have more than he can advantageously use, the maximum being set at 1 foot per second (second-foot) for each 70 acres. This having been done, each appropriator is given a certificate setting forth the order of priority, amount of water properly his, and the number of acres upon which it is to be used.

Prior to 1891 claims to water were recorded in the office of the county clerk of each county. Now, however, all records are made in the office of the State engineer. This was a much-needed change. The engineer now has before him the requisite data for his labors and his decisions. Touching the records under the old and the new law he says in his last report, but lately issued:

These (records) have been carefully compiled, all the claims to water from each stream or source of supply grouped together, and an abstract of the claims in each division, irrespective of county boundaries, prepared. From these abstracts a careful summary of the progress under Territorial laws has been made. In making this all the sources of information at the command of this office were utilized. Statements known to be erroneous were rejected. Duplicate statements of the same claim were often recorded in several counties; these were eliminated in preparing the abstract. Speculative filings, where the recording of the claim was the only step taken to secure an appropriation, were omitted wherever known. In all, about one-third of the recorded statements were omitted from the summary. The totals of the summary were further reduced by the failure of many to state the essential facts. \* \* \* The total acreage, as given, represents therefore only 2,200 instead of over 3,000 statements, and so with the other amounts in the table given below:

TABLE 10.—*Summary of claims to water, as recorded in county offices prior to 1891.\**

Water division.	Total number of ditches.	Total sources of supply.	Total acreage said to be irrigated.	Volume of water in cubic feet per second.
1.....	1,575	263	1,407,940	9,233
2.....	667	136	346,586	10,808
3.....	276	74	75,673	3,741
4.....	368	158	342,582	2,857
Total.	2,886	631	2,172,781	26,639

\* From abstracts in State engineer's office.

Commenting upon the foregoing table the State engineer notes, first, the inaccuracy of figures in his office as to particular streams, and secondly, that owing to the great number of small ditches unreported the acreage in the table is less than the real amount. He feels warranted in concluding that there are now over 2,000,000 acres of land under ditches and susceptible of being irrigated from them; but also very properly shows that no such amount is actually irrigated at the present time, adding:

According to the census report for 1890 only about 10 per cent of the land under ditch is irrigated and only about 1 per cent of the land under ditch is cultivated; the report showing that 229,000 acres were irrigated and a little over 20,000 acres devoted to the production of cereals.



The figures (Census Bulletin No. 107) make the following showing of the acreage under cultivation and the value of product in each of the several counties:

TABLE 11.—*Acreage of land cultivated and value of product, 1890.*

County.	Number of irrigations.	Total irrigated acreage in crops.	Average size irrigated farms, in acres.	Average value of products per acre.
Albany .....	125	34,522	276	\$9.30
Carbon .....	272	39,869	147	6.83
Converse .....	72	6,890	96	6.72
Crook .....	59	3,027	51	10.15
Fremont .....	217	15,512	71	12.25
Johnson .....	278	28,106	101	7.97
Laramie .....	208	33,853	163	12.44
Natrona .....	43	5,547	129	(*)
Sheridan .....	294	29,722	101	6.94
Sweetwater .....	20	1,362	68	( )
Uinta .....	324	30,918	95	6.09
Weston .....	5	348	70	7.59
Total .....	1,917	229,676	119	8.25

\* Returns of values of products not complete.

The reader, in noting the rather small value of the product per acre, should bear in mind that the bulk of product is hay, even yet, notwithstanding the steady and in some localities rapid increase in the proportion of grain and wheat crops.

#### GENERAL RESULTS OF IRRIGATION.

The results of all these efforts of the legislature and of Territorial and State officials are only now beginning to make themselves in any important sense apparent. The vast aggregate sums invested in irrigation works have, in many cases, not reached the point of realization at all; the canals and ditches in the construction of which they were used have not been wholly completed, or delays in the perfecting of titles to the lands to be watered by them have postponed the beginning of practical operations. This is especially true of the more important of these enterprises.

#### LARAMIE COUNTY.

Thus Laramie County is claimed to have simply passed from a purely pastoral condition to one of mixed husbandry. Stock-raising, farming, dairying, and gardening in a partial way are practiced in varying degrees. The summer is long; the average temperature about 60° F.; the rainfall 14 inches; frosts up to the middle of May, and again from the middle of September. All field crops common to the West, except Indian corn, succeed very well.

The development through irrigation has been confined to no particular division, on the one hand, nor has it been very considerable in any part. The works near the Laramie range, to wit, on the little streams which flow southward into the Poudre of Colorado, on the

Crow, Lodge Pole, and Chng, as well as on the North Laramie, Cotton, and Horse Shoe, are still mainly for the production of hay; but lower down, especially on Horse Creek and other little streams emptying into the North Platte near the border of Nebraska, general farming has been commenced with excellent results. The soil is exceedingly fertile, the water reliable, and the altitude sufficiently low to warrant the trial of any of the ordinary field crops. The creeks are lined, therefore, with new-made farms in the hands of ambitious cultivators, who by combining farming and stock-growing are having a prosperous career.

#### CONVERSE COUNTY.

Converse County, though still mainly devoted to stock-growing, has undergone important transformations where irrigation is easy, and something at various points on the line of the Fremont, Elkhorn and Missouri Valley Railway has also been done without the help of irrigation. Its temperature and rainfall are about as in Laramie County, and its soils are in like manner characterized by a predominance of the reddish and dark sandy loams.

Spring wheat of the Slosson, Fultz, Russian, Ruby, and Italian varieties makes a good yield, say 20 and 45 bushels. Rye, both spring and winter, also makes a good crop. White oats are a marked success, White Swedish, White Russian, and American Wonder being preferred. Buckwheat, barley, millet, flax, peas, and beans have likewise had a very successful trial. Even corn ordinarily matures and is especially grown for fodder, Yellow Dent and White Ensilage being preferred for this use.

Of the tame grasses suited to this whole region, embracing Laramie, and Converse counties, alfalfa, redtop, and timothy are chief. Experiments with alfalfa and oats sown together in the month of April have been quite satisfactory. The oats serve as a protection to the alfalfa, which, being once established, two and three crops are cut annually, with a yield of 5 to 8 and in some cases as high as 9 tons of hay.

The ordinary root crops do well and the sugar beet has in some instances produced 23 per cent of sugar. Nevertheless, it is said that not over 1 to 3 per cent of the arable land is under cultivation. While a few irrigation companies are at work preparing for large operations, most of the irrigation done is by individual farmers.

#### WESTON AND CROOK COUNTIES.

Weston and Crook counties, although enjoying a low altitude and possessing good soils, are not quite so well watered as some other sections, and, depending as they do to a large extent, upon the rainfall, have now and then suffered for want of a water supply at the critical season. Moreover, including a portion of the Black Hills, with oil springs and mines of coal, tin, silver, and gold, attention has been very much directed to other sources of wealth, to the comparative neglect of



agriculture. It is in Weston County, however, and upon the table-lands with their dark loamy soils, where the Messrs. Kilpatrick have made so marked a success in farming without any attempt at irrigation or so much as the practical possibility of it.

The fertile, reddish gypsum soils found at the base of the table-lands are so retentive of moisture that crops grow in the regions where they characterize the lands without much if any irrigation; the rainfall amounting to about 17 inches, and the summer temperature averaging 60° F. The chief precipitation is in the spring and early summer and the crops make rapid progress from germination to maturity. All the farm crops known in northern latitudes are produced in this region, even Indian corn, and the yield, under conditions at all favorable, is most excellent. Wheat of the spring varieties, such as Fife, Oregon, and Niagara, often yields over 50 bushels; rye, over 40; oats, 70 to even 100 bushels; and corn of the Flint, Dent, Squaw, and other varieties also make a good return. Timothy, alfalfa, red clover, and other tame grasses are cultivated with success; as also are potatoes, rutabagas, mangolds, turnips, carrots, and sugar beets, the last named producing as high as 6 tons per acre with 20 per cent of sugar, as shown by analysis.

Of the region about Newcastle it is said that not over one-tenth of the arable land, itself one-fourth of the whole area, is under cultivation of any sort.

#### ALBANY COUNTY.

Albany County, whose cultivable areas have an altitude of 6,000 to to nearly 8,000 feet, is, as before remarked, in some respects unique, embracing as it does the broad and beautiful expanse known as the Laramie Plains, whose climate, further tempered by the snowy ranges, is exceptionally cool, and yet whose smooth surface, fertile soils, and abundant streams especially fit them for the cultivation of the hardier crops. Full one-half the area of these elevated plains is arable, and a very considerable proportion of this may be reached by the Laramie River and its many tributaries. The average summer temperature is 60° for the lower and northern portions of the county and 50° for the high table-lands. The rainfall is 8 to 14 inches. Killing frosts may be expected as late as May and as early as September. The lighter frosts may occur in almost any month of the year.

Because of the great elevation and consequent coolness of the climate, the people of the Laramie Plains have been slow to make trial of the capabilities of that section. Mr. Lawrence Fee has been producing excellent crops of grain, tame grasses, and vegetables on the banks of the Big Laramie, and within the corporate limits of Laramie City, for a number of years. Various trials on a larger scale have also been made at several points higher up on that stream, and a yet greater number on both sides of the Little Laramie. The irrigation has been chiefly done by individual experimenters, but the great body of lands between

the two Laramies is in the hands of a large stock company, which already has very considerable canals and ditches constructed or in process of construction, and is fully confident of future success. And yet the per cent of cultivable land at present in use is insignificant.

Of the crops and varieties tried and approved, mention may be made of the following: Spring wheat, White Russian, Fife, Chile, and Orange Red; oats, White Russian, Black Tartarian, Excelsior, and Welcome; buckwheat, Japanese; barley, the four-rowed and six-rowed; flax, both common and European; pease, Canada and Early May; millet, African and German. All sorts of root crops make an astonishing yield. I have seen single turnips grown at an elevation of over 7,500 feet so large that one of them could barely be squeezed into a half-bushel measure, and yet firm and solid all through, as well as especially sweet and pleasant to the taste. Rutabagas likewise do remarkably well, and the sugar beet gives promise of so great a success as to justify the erection of a factory for sugar manufacture at Laramie City.

The tame grasses in ordinary use elsewhere—timothy, red top, and alfalfa—have succeeded well in this high region also. Alfalfa is usually sown with oats, since the two together better hold the snow as a winter protection until the alfalfa is established. Timothy is often sown broadcast on a melting snow, or drilled in very early. It is also sometimes sown directly upon the sod and flooded soon after.

#### CARBON COUNTY.

What has been said of Albany will for the most part answer for Carbon County also, for while it is wanting in extended table-lands like the Laramie Plains, its altitude is nearly as great; it is also shut in by mountains—the Medicine Bow, the Seminole, and Sierra Madre; is watered by the Platte and its many branches, and has a valley and upland soil no less marked for its fertility. North of the Union Pacific Railway there are alkaline flats of some extent as well as a small district of sand dunes, but these together constitute but a small fraction of the whole area.

The soil is a clay loam near the foothills and a sandy loam in the valleys. The best soils for cultivation are the bench lands forming the divides between the smaller streams which flow into the Platte from either side at intervals of but 4 or 5 miles or less. The crops successfully grown are substantially those last above mentioned. The White Russian wheat does particularly well. Rye of the Dutch winter variety has given a good account of itself in some instances, and the same is true of barley, both spring and winter. Oats make a good yield and are of good quality. Peas, millet, and all sorts of fodder crops furnish a rich and nutritious food for stock, as do the root crops of every sort. The sugar beet is said to make enormous yields with 16 to 20 per cent of sugar.

The irrigation hitherto practiced has been by individuals almost en-

tirely, but a number of large companies have formed and are forming for the construction of canals of a size sufficient to bring any considerable areas of the Platte Valley under water, and thus make of it one of the most important agricultural districts in the State.

#### NATRONA COUNTY.

Natrona County makes up in lower altitude what it loses in latitude, and thus bears comparison with the two adjoining counties on the south last above reported. The temperature is a little warmer and the rainfall is rather less. Its soils are of about the same general character. Its streams of water are the North Platte; its chief tributary, the Sweetwater, flowing from its sources in the Wind River Mountains; several lesser branches, including Casper Creek; and in the northern portion Willow, Buffalo, and other head waters of the Powder.

While a number of farms have been opened and improved along several streams above mentioned, I do not learn that any very marked development has yet been made. The settlers on the Platte and the little affluents of that river below the cañon in the Seminole Mountains have confined themselves largely to hay crops. In the valley of the Sweetwater, between its cañon and the western line of the county, some of the ranchmen, devoted principally to stock-raising, have succeeded in growing some very good field as well as garden crops, and below the cañon, in the neighborhood of Table Rock, a ditch or two of importance have been constructed for the watering of considerable bodies of land, which, though more than usually sandy in places, is found to be highly productive.

The northern portion of the county, being without strong perennial streams, is almost entirely given up to the range cattle business.

#### JOHNSON COUNTY.

The county of Johnson is already widely known as an agricultural district because of its extraordinary success in certain lines, especially in the growing of potatoes. The greater portion of the farming lands lie in the heart of the county, on the eastern slope of the Big Horn Range, whence a great number of crystal streams make their way to the Powder River. It is in the valleys of these little creeks and on the fertile slopes adjacent that agriculture and gardening have made so good a beginning. Farther down the valleys broaden, affording opportunity for large ditching enterprises, some of which are already in progress. The soil of all the valleys is a sandy loam, dark, and exceedingly fertile.

The climate of this district is a little warmer, the average temperature being about 65° F. The rainfall rarely exceeds 12 inches per annum. The atmosphere, thus dry and warm, is kept in motion by the northwestern currents already alluded to as seeming to come around the head of the mountain range from the Pacific side of the continent.



The conditions indicate the somewhat changeable climate with which the dwellers in that section are familiar.

The cereal crops of every sort grow to perfection where duly supplied with water. Wheat makes a great yield; the Scotch Fife, Reliance, club, and amber receiving most attention. Winter wheat has done well in many instances. Rye and oats make large yields.

It was in this garden spot that Mr. Sturgis obtained a potato yield of 974 bushels and 48 pounds per acre in 1890, and that crops of every sort of roots so well repay the farmer. The garden vegetables common to lower and warmer regions succeed remarkably here also. One of the finest gardens the writer ever saw in any Western State is to be found in the immediate neighborhood of Buffalo.

The fact that the wild cherry, wild plum, the buffalo berry, the gooseberry, and raspberry, are commonly found along the little streams and among the hills was deemed sufficient warrant for the trials made in fruit-growing, whose success can not be doubted.

Stock-growing makes an excellent accompaniment of farming throughout this region. Shorthorns, Herefords, Sussex, and West Highlands find special favor for the range; the Shorthorn, Jersey, Ayrshire, and Holstein for the dairy. Horses also receive much attention, and are increasing in importance. The Percheron for draft, the French and English coach horses, the Hambletonian, and Morgan, with crosses of these with the breeds above-named find special favor. Swine seem to be a natural accompaniment of a corn crop, and to find place in proportion to its success; and accordingly they are found in considerable numbers here as they were found in western Crook. In the summer season they feed on alfalfa and in winter are served with a diet of chopped corn. The Berkshire, Poland-China, and Red Jersey breeds seem to be preferred.

Buffalo, the live and progressive county seat, together with the garrison at Fort McKinney, but 3 miles distant, afford something of a local market, but the larger development of this section like that of many others must yet longer wait for railroad development.

#### SHERIDAN COUNTY.

Another garden spot is that immediately north of Johnson and known as Sheridan County, whose western boundary follows the crest of the Big Horn Divide in a northwesterly course, and whose northern boundary abuts upon the State of Montana. Though farther north its altitude is something less, that of Sheridan, the county seat, being a little under 4500, feet. The multitude of little streams—affluents of Clear Creek and Tongue River, which flow northward and northeastward on their way to the Powder and Yellowstone—having their sources in the lofty Big Horn range, are among the most beautiful in the world; clear and cool, sparkling, and abounding in speckled trout. The landscape all around the base of the mountains is one of surpassing beauty—of such enchant-



ment, indeed, that the writer, when in 1878 he first crossed the beautiful valleys of the many tributaries of the Powder and Tongue, could not deny himself the pleasure of halting the escort accorded him for such sketches as could be hurriedly made of it.

No wonder that this region was the favorite haunt of the Sioux and other Indian tribes. No wonder, indeed, that they who had rejoiced in its exceeding beauty and in the value of the natural resources of its stream and mountain wilds, were moved to make their last and famous stand for its defense against the encroachment of white men.

But one thing seems wanting to insure to Sheridan a rapid development. Its fertile soils, its pure and beautiful waters in network, at once abounding in fish and supplying the means of economical irrigation, its streams lined with timber, with the neighboring forests abounding in splendid growths of all the ordinary evergreen species, and last of all its soft and beautiful climate, suited to the production of farm, garden, and orchard crops of most kinds—all these resources, supported by the evidence already afforded by actual trial in every branch of agriculture, horticulture, and stock-raising, justify the earnest demand made by the people of Sheridan for railway facilities and give every needed assurance of ultimate success.

#### BIG HORN COUNTY.

The account already given of the Big Horn Valley, with its magnificent streams, having their sources in the Shoshone Mountains, east of the Yellowstone National Park, and its fewer streams flowing out of the Big Horn range, was sufficient to show the capabilities of this interesting and fertile region. As yet the actual development in agriculture has been quite partial, as would be expected in view of its more recent settlement. Eighty-eight bushels of wheat per acre in the vicinity of Big Horn village, with large yields of oats, rye, barley, potatoes, and root crops generally, show what may be expected under a more general and systematic culture. Gardening and fruit culture have also made sign of large possibilities. The Big Horn River, as already remarked, has for the most part too deep a channel to require easy development in irrigation along its banks, but its many affluents afford every desirable condition. Live stock of every sort may be found here already, and is destined to prove a profitable accompaniment to agriculture when duly systematized and developed.

Besides all the cereal crops usually produced in other sections, crops of excellent Indian corn have been grown on the Passamaria, Grey Bull, and perhaps the other streams also; the yield being in some cases as high as 60 bushels of sound corn.

#### FREMONT COUNTY.

This county was quite early in getting a start in agriculture. The large promise of the gold mines long ago discovered in the Wind River Mountains, inducing a number of settlements along the eastern slope

of that range, the early establishment of a military post for the better security of such settlers, and, finally, the more permanent location of Fort Washakie in the beautiful valley of the Wind River, in the midst of the Shoshone and Arapaho Indian Reservation—all these were the means of improving and developing the beautifully watered and low valley of the Little Wind, and of making the county seat of Fremont a farming and finally a milling center. No railroad has yet penetrated that promising region, but meanwhile the mining towns of South Pass, Atlantic, and Miners Delight, the advancing town of Lander, county seat, the garrison at Fort Washakie, and the more than 2,000 Indians on the reservation afford something of a market for products of every sort, and have justified the erection of flouring mills for the grinding of the grain there produced.

The more than usually heavy snowfalls in April and May, which characterize this region, insure the early germination of seeds, as well as a bountiful supply of water in all the streams that will eventually find storage in the many basins to be found at points accessible and available for reservoir purposes.

In the division of grain crops the Club, Fife, and Touse are in favor, producing a sound berry and making a large yield. Twenty-five to 40 and even 60 bushels are reported yields. The White Russian and Welcome oats make yields of 30 to 80 bushels of 40 to 45 pound oats. Barley does equally well, the five-rowed and six-rowed finding favor and yielding as high as 60 bushels per acre. Buckwheat, field peas, beans, and root crops of every sort swell the list.

Fruits have also given good promise of success. The northwest winds are to be provided against in the case of fruit trees, and the smaller fruits require covering with earth for winter.

The work of irrigation is making steady progress, most of it being that conducted by individual farmers. The facilities are most excellent.

#### SWEETWATER COUNTY.

The county of Sweetwater furnishes good ranges for cattle and sheep, and is by no means without the possibilities of a profitable agriculture; but it is preëminently a coal-producing region and has done less than many others in the production of either agricultural or garden crops. On the Green and some of its branches there are natural facilities for cultivation, especially on the Sandy, flowing out of the Wind River range and commanding (though not without considerable cost, as before remarked) large areas of productive lands, and also on a number of the smaller branches of the Green, south of the railway and bordering on Colorado.

#### UINTA COUNTY.

The county of Uinta, directly west of Sweetwater and Fremont counties, and bounded on its western side by Utah and Idaho, with Utah also on the south and extending northward across over four par-

alleys of latitude to the southern boundary of the Yellowstone National Park, embraces a great variety of soils, exposures, and climates, and notwithstanding its greater altitude than that of the districts deemed especially agricultural, still has a future. This has been demonstrated by the beautiful farms in the very suburbs of Evanston, its county seat, whose elevation is about 7,000 feet, as well as by the quite large farming operations in the valley of the Bear on the boundary of Utah, by the success of the Mormon settlements on the Snake and Salt, and finally by the excellent results achieved on those fine little streams, which, flowing out of the Salt River and Gros Ventre ranges, empty their waters into the Green River on the east.

The work of irrigation thus far done has been almost wholly that of individuals and private business firms, the most important of them being on the Bear River north of Evanston, and on the Fontenelle, La Barge and Black Forks of the Green. Hitherto stock-raising, next after coal mining, has been the principal industry, and even yet, with the qualifications above suggested, agriculture is rather an incidental accompaniment of stock-raising than an independent branch of industry.

All the tame grasses grown elsewhere in the State flourish here, also the cereal and root crops common to the higher portions of Wyoming.

#### CULTIVATION OF PARTICULAR CROPS.

Hitherto in this account of Wyoming agriculture, conditions, means, and agencies have been almost exclusively considered; it remains to speak more especially of the results of all these in the production of the principal crops grown in the State.

The cereal crops are grown both for bread and for fodder, and are steadily gaining ground in all portions of the State. The full watering they have by systematic irrigation insures superior plumpness, weight, and quality of grain, so that, when water is available and the altitude not too great, both the spring and winter varieties may be successfully grown.

#### WHEAT AND RYE.

The favorite varieties of wheat vary somewhat for different sections, one being preferred here, another there; partly, no doubt, because of real difference in conditions, as of climate, exposure, soils, etc., and partly because of partialities growing out of a first successful introduction in a given neighborhood. Taking the whole State over, the several varieties would perhaps fall into the following order of mention: Fife, White Russian, Chili, Club, Oregon Red, Amber, Ruby, Reliance, Touse, Niagara, Velvet Chaff, Italian, and Sawatchkan; the last half dozen found only occasionally, though making extraordinary yields in some instances. Of course, it is spring wheat that is chiefly



produced, although winter wheat also succeeds at low altitudes and under favorable conditions. The May winter variety has done well in some cases as high as 7,000 feet and over. The Fultz and Slossen have also succeeded well.

The usual time for putting in the spring grain is April, or in other words, as early as practicable; for winter varieties, September. Drilling is preferred, making the rows north and south when the surface will admit of it, or at right angles to the prevailing winds.

The yield reported runs all the way from 20 bushels to 88; the last and highest being of the Amber variety, grown in the Big Horn Valley.

In further proof of the progress of wheat-growing it may be stated that flouring mills are permanently established in Albany, Carbon, Johnson, Weston, Crook, Sheridan, and Fremont counties, and probably elsewhere in the State.

#### RYE AND BUCKWHEAT.

A number of varieties of buckwheat are well adapted to this mountain climate, but it is not extensively grown in any section. The varieties used more generally are the Japanese and Silver Hull.

Rye succeeds well, often making great yields. It is sown not a little in some localities as a forage crop. The favorite spring varieties are Salter's, Wild Goose, Giant, and Dutch; the winter varieties, the Dutch, German, and Black.

#### OATS.

Here we have one of the leading crops—the grain crop which most of those reporting have named in answer to the question, “Which crop leads?” Oats succeed everywhere in the State, producing 35 to even 100 bushels per acre. The plant usually cures bright and makes excellent forage. They are sown or planted as early as possible in the spring, usually in April, when the condition of the ground will admit of it, or even in the fall, in which case they are ready in the soil for earliest sprouting under the spring rains.

The varieties more commonly grown may be named in about the following order: White Russian, Welcome, and Tartarian. The Excelsior, Bonanza, Iowa, Side, Giant Side, American Banner, American Wonder, Mane, Siberian, White Dutch, and Early Dakota are also said to have given satisfaction.

#### BARLEY.

Barley is not grown to so large an extent as either of the foregoing, simply because there is less demand. It succeeds equally well, and is grown to some extent in all the agricultural districts. Two-rowed, four-rowed, six-rowed, and Mansbury spring varieties are cultivated. Okshott's is preferred as a winter crop, being put in about the middle of August or first of September.



## INDIAN CORN.

Almost anyone would have declared in advance that corn should not be expected to amount to anything worth mentioning at an altitude so high as Wyoming, and probably no one of all who have experimented with it began on a larger scale than a garden-like patch. And yet in portions of Natrona, Johnson, Converse, Weston, Crook, and Sheridan counties it is reported as being worthy of a place among field crops. The stalk and leaves make so sweet and nutritious a fodder, when cured in the dry autumn of this region, that it would pay well as a forage crop, even if the grain itself should not mature. Yankee Flint is said to have yielded 70 bushels per acre in Natrona County, and excellent crops are also reported from eastern and northern Wyoming. Flint, Yellow Dent, Angel of Midnight, Whiteley Dent, Pride of the North, Wyoming, Ninety-Day, Maiden, and Squaw are the varieties grown for the most part. The planting is early in May. For fodder, merely, Sweet, Squaw, and Dent are recommended.

Kaffir corn, Dhoura corn, Mill's maize, Kaffir sorghum, German and African millets, and doubtless still other like crops for forage have been experimented with and given good satisfaction.

## HAY CROPS.

The best grasses for tame hay are timothy, alfalfa, and redtop. These succeed in all sections. Orchard grass also gives satisfaction in many places.

Timothy makes enormous yields under favorable conditions, and has been known to produce as much as 3 tons per acre when sown upon natural sod and flooded—a method now quite common.

Alfalfa has been a godsend to Wyoming. It may be cropped two and three times, thus making a total yield of 5 to 9 or 10 tons an acre; is one of the most nutritious and fattening of feeds, requires but little irrigation, and readily admits of cultivation with oats; indeed, in the opinion of some, is best sown with oats, since by this means one extra crop is gained; the month for sowing, April. The young alfalfa and oat stubble together hold the snow as a blanket for protection, and thus give added security during the first winter. It may also be sowed with spring wheat. In all cases the irrigation should be discontinued in time to ripen the alfalfa as a means of preventing the killing in winter, and for a like reason the aftermath should not be pastured.

Redtop is next in favor, being readily established, producing excellent hay relished by all kinds of stock, and making a liberal yield. It is often sown upon sod in early spring, with after-flooding the same as timothy. In eastern and northern Wyoming red clover does well, as do also the orchard and Johnson grasses.

The favorite wild-hay grasses are the blue-stem and blue-joint. Gramma or buffalo make a good supplement.

## POTATOES.

The winning of the first premium for yield of potatoes, in competition with producers in all parts of the United States, has given Wyoming a world-wide distinction in this particular branch of agriculture and stimulated to further effort. Both climate and soils seem suited to it in a high degree, so that the quality of the tuber is most excellent and the yield enormous; the returns from circulars of inquiry showing crops of 100, 150, 200, 300, 350, 400, and so on, even to 975 bushels per acre. The last-mentioned yield was gained by Mr. Solomon Sturgis, of Johnson County, who some two or three years since won the high prize above referred to.

The early varieties grown are the Early Rose, Early Ohio, Early Minnesota, Clark's No. 1, Early Snowflake; late varieties, the Mammoth Pearl, Blue Victor, White Elephant, Late Rose, Burbank, Iron-clad, Invincible, Beauty of Hebron. All varieties attain to unusual size, and soundness, mealiness, and sweetness are quite universal characteristics.

As a rule, potatoes require irrigating but once—just before blossoming; but in very dry seasons a still earlier watering may be desirable.

## ROOT CROPS—THE SUGAR BEET.

Rutabagas, sugar beets, marigolds, turnips, carrots, and artichokes all flourish in Wyoming, attaining extraordinary size and yield, with quality hardly surpassed anywhere.

In view of the facts that the United States is obliged to import about nine-tenths of all the sugar consumed, and of the probability that we should use very much more than at present if it were cheaper, there is full warrant for extraordinary efforts to create a supply at home if it be at all possible to do so. The present sources of saccharine matter are the sugar cane, the maple tree, and the sugar beet. But the total production of cane sugar in the whole country is less than 250,000,000 tons, that of maple sugar less than 30,000 tons, leaving nearly 1,000,000 tons to be imported annually or to be produced from the beet.

As a matter of fact, more than half of all the sugar at present consumed in the world is derived from this very source, the larger proportion of this half being furnished by the countries of central Europe. But there seems to be no good reason why this country should not also take up this important industry and early supply its own people. Already a beginning has been made, and that, too, in States and Territories which adjoin Wyoming on the east and west. The product of the factories in Nebraska, Utah, and California during the years 1891-'92 was over 13,000 tons, and other factories are planned on the strength of the results already achieved.

While the cane is a semitropical plant, the beet flourishes best in a

cool region with an average summer temperature of about 60°—precisely that of Wyoming. Again, the beet succeeds best in a climate where the autumn is dry, for the ripening process essential to the conversion of the starch into sugar—just the climate of Wyoming. Last of all, successful cultivation of the sugar beet depends not a little on a porous soil as well as on control of moisture—conditions both very perfectly fulfilled in Wyoming.

There was full justification, therefore, for the following strong statement of the case by Prof. Dice McLaren, of the University of Wyoming and director of the Wyoming Experiment Station at Laramie, as published in Bulletin No. 3 of the agricultural college department of that institution:

Wyoming is a natural sugar laboratory. The dry autumn of the arid region causes all the native plants to ripen large stores of starch and sugar in root and bulb for rapid growth the next spring. The sugar beet is no exception to the rule. Its cultivated tendency to store starch and change the same to sugar is here greatly increased by climatic conditions. Irrigation in summer causes a luxurious growth of leaves. As the water supply is gradually lessened these leaves elaborate large quantities of starch and sugar to be stored in the thickening root. The irrigation is stopped, and the dry autumn thoroughly ripens the beet, changing the starch to a rich store of sugar. Both Wyoming and Utah experience demonstrates that the irrigated beet is much richer in sugar than the beet that is prevented from ripening by the heavy fall rains of the humid region.

Prof. McLaren adds:

The trial fields of sugar beets grown by the Wyoming agricultural experiment station prove that both the soil and the climate of Wyoming are adapted to producing a beet so rich in sugar that chemical analysis has shown a maximum of 22.18 per cent of sugar and an average of 15.79 per cent for the entire State. The best yield per acre was 24 tons, analyzing 17.83 per cent of sugar. It is clear that Wyoming can have as successful beet sugar factories as those in Utah and Nebraska.

The physical and chemical conditions to be fulfilled in order to success in beet culture appear to be these:

(1) Neither a stiff clay nor a rich alluvial soil will answer. The one will result in small ill-shaped beets, the other in overgrowth with deficiency of sugar. A sandy loam would seem to meet the demand.

(2) There must be good drainage, natural or artificial, in order to the proper control of moisture during the growing season.

(3) There should be the deepest of plowing, or subsoiling, by way of providing a soft bed for the root, fall plowing being preferred.

(4) There must, of course, be a full supply of the requisite chemical substances, as shown by analysis, those especially necessary being nitrogen, phosphoric acid, potash, lime, and magnesia. Relative deficiencies on the part of either of the alkaline constituents will be supplied in most soils by one of the others, but nothing can serve as a substitute for phosphoric acid or nitrogen. The acid is essential to sugar, and nitrogen to a thrifty growth of the plant. The relative quantity of each constituent consumed by the roots and leaves of the



beet plant for the formation of 100 pounds of sugar is said to be as follows:

	Pounds.
Nitrogen .....	2.7 to 3.5
Phosphoric acid .....	1.0 to 1.20
Potash .....	5.0 to 6.0
Soda .....	1.5 to 2.0
Lime .....	1.5 to 1.6
Magnesia .....	1.2 to 1.4

The simplest means of supplying these constituents where not abundant in the soil is to use barnyard manure, applying it a year in advance of cultivation. The leaves of the plant left in the field should also be plowed under as a further means of enrichment.

#### VARIETIES—CULTIVATION.

The Vilmorin Improved and Kleinwanzlebener have been produced by careful selection in Europe during a long period and are regarded as best varieties. Others are regarded with favor also, but concerning these there is no question.

The method of cultivation recommended by the director of the Wyoming Experiment Station is this:

The seed bed should be thoroughly pulverized, killing the young weeds just before planting. As soon as the ground is warm the seed should be planted about 2 inches deep in drills from 16 to 24 inches apart. If hand-planted, 10 to 15 pounds of seed per acre is sufficient. If drilled in, 15 to 20 pounds of seed is used. Any good garden drill will do, and grain drills can be used by closing some of the openings. In order that the seeds may absorb the soil moisture readily, the earth should be pressed close to them by a following wheel with about a 2-inch tire. This is the principle of the roller-press drills. The depressed seed row acts as a catch-basin for the slight rainfall and at the same time shelters the seed from the drying winds. Rolling the whole ground has proved injurious on the fields of the Wyoming Agricultural Experiment Station, as it seems to bring all the soil moisture to the surface, to be swept away by the dry wind. Seed drilled on the crests of ridges remains dry in this climate until the furrows between are filled with irrigation water. Cultivation tends to uncover the tops of beets growing on these ridges, and the uncovered portion is unfit for sugar.

If the ground be so dry that the seed must be irrigated up, the ground should not be flooded, for thereby many seeds will be washed away and the sprouting seeds force their way with difficulty through the resulting caked surface. Shallow irrigating furrows should be made midway between the rows and the water will reach the seeds by seepage. These furrows can be made at the time of drilling by an attachment like a corn-row marker, which could also be used separately after drilling. If the ground is wet enough to bring up the seed, the irrigating furrows need not be made until the operation will kill many sprouting weed seeds. The further cultivation can be done with the hand hoe and the many forms of garden and horse cultivators. The soil should be kept mellow. The more cultivation the more sugar. The soil must not cover the young plant, but it is a good plan to throw as much earth as possible toward the older roots, to cover the top of the beet. In any part of the plant exposed to light, much of the starch and sugar is changed to chlorophyll, causing a green color. The hilling is not necessary, as good varieties of sugar beets grow very little root above ground.



When the beets have from four to six leaves, they should be thinned to single plants, 4 to 8 inches apart in the row. Thin to 4 inches in very rich ground and to more than 8 inches in very poor ground. If two or more beets grow close together the result will be twisted, ill-shaped roots that are hard to clean in the factory. To get single plants the hand must assist in the thinning and the weeds should be pulled at the same time. Some of the plants can be cut away with a narrow hoe and the soil on both sides of the row loosened. The thinning is often done by children. When the beets are a few inches high the work can easily be done with a horse cultivator. The farmer should aim to grow a smooth, rich sugar beet, weighing from 1 to 2 pounds.

The long roots of the beets gather so much moisture from the subsoil that they require less irrigation water than the shallow-rooted grains and grasses. During the fall the beet requires a dry surface soil to elaborate sugar, and will thrive in the same, getting all the moisture it needs from the summer irrigated subsoil. Stop the irrigation early. Guard against seepage from surrounding land.

#### HARVESTING AND STORING.

Sugar beets should be harvested when they contain the most sugar. In this climate they should be allowed to grow as long as possible. Five degrees of freezing, or 27° F., does not injure the beet in a damp climate, and experiments in Wyoming indicate that in our dry air even 20° F. does not lessen the sugar. As the colder weather ripens the beets the leaves turn yellower, their chlorophyll and starch being stored as sugar in the root. The more sugar there is in the beet the more rapidly a freshly-cut surface will turn brown. At this stage or just before a threatening cold wave the beets should be dug. By means of a hand-lifter, a horse-lifter or by furrowing close to the roots with a common plow, the beets are loosened in the row and then removed by hand. For immediate factory use the green part of the root is cut square off, but for storing and feeding the leaves only are removed. Bruising or cutting the beet wastes the sap.

The leaves may be fed to cattle and sheep, but it is best to plow them under as a fertilizer. The roots may be stored in a root cellar, keeping best between layers of earth; or they may be placed in long pits 1 foot deep and about 6 feet wide. Along the middle of the pit pile the beets with the root end inwards and downwards to a height of 1 foot, cover with 6 inches of soil, then pile another layer of beets, cover with another layer of soil, and so on until a steeply sloping ridge is formed.

Straw or hay next the beets tends to rot them. Before the coldest weather cover deeply with earth. Beets thus pitted will keep till spring with little loss. If frozen they should be thawed very gradually or much sugar will be destroyed. Fed with hay or straw, sugar beets will fatten cattle and sheep, or if cooked will fatten hogs. For table use sugar beets are better than the red garden beets, being sweeter and less fibrous.

#### COST OF RAISING.

The cost of raising an acre of sugar beets in Wyoming is about twenty days' labor. Estimated at \$2 per day it would be as follows:

Plowing 1 acre, team one day .....	\$4.00
Harrowing and clod crushing, team one-fourth day .....	1.00
Drilling and making irrigation furrows, team one-fourth day ....	1.00
Thinning and weeding, man five days .....	10.00
Irrigating, man two days .....	4.00
Cultivating, team one day .....	4.00
Harvesting, man four days .....	8.00
Storing or hauling to factory, team two days .....	8.00
Total .....	40.00

By personal supervision the farmer can reduce this cost. Rent of irrigated land is not included, being the same for all crops. With proper cultivation the yield will vary from 10 tons of rich beets to 30 tons of larger beets. The average price per ton this season is \$3.50 in Nebraska, \$4 in California, and \$4.50 in Utah. The value varies with the sugar content.

It but remains to add that while the cost of factories of economical capacity is very considerable, amounting to something like \$1,000 to \$1,500 per ton daily capacity, and which should not aggregate less, perhaps, than 1,000 tons per season, the entire success of the many experiments tried in Wyoming afford every desired encouragement, and would seem to place the early introduction of this important industry beyond question.

#### LIMITED PRODUCTION OF FIELD CROPS.

After the foregoing account of agricultural possibilities and actual achievements here and there in the several counties and in the cultivation of various crops, I should not omit to say that as yet Wyoming agriculture has yielded but very partial results in any section. In most quarters it has been chiefly confined to the production of hay, with but secondary attention to potatoes and root crops except in a few districts, and with scarcely more than experimentation in the great division of cereals, as will appear by the following table from bulletin No. 184 of the last census. Since that date (1890) much new development has been made in some quarters, as important irrigation works have multiplied, but as a general statement the remark still holds true.

TABLE 12.—*Production of cereals in Wyoming, 1890.*

County.	Barley.		Buckwheat.		Indian corn.		Oats.		Rye.		Wheat.	
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
Albany .....	1	40			6	110	395	12,005			6	127
Carbon .....	22	190	10	40	1	10	1,384	26,343			56	1,137
Converse .....	13	85					428	12,403	13	112	174	508
Crook .....	24	202	2	15	677	9,350	2,044	46,853	35	292	948	11,510
Fremont .....	46	1,042			8	160	2,050	48,083			1,094	17,066
Johnson .....	131	4,027			68	1,886	2,607	71,641	75	1,549	195	12,898
Laramie .....	6	50			1,052	9,021	989	23,012	18	102	39	730
Natrona .....		6,127					52	1,210				
Sheridan .....	243		8	85	165	4,635	4,310	138,506			1,257	26,279
Sweetwater .....							26	970				
Uinta .....							382	6,204			315	4,195
Weston .....							40	1,275				
Total .....	486	11,763	20	140	1,977	25,172	14,607	388,505	141	2,055	4,584	74,450

#### RECENT PROGRESS.

While there has been no general collection of the facts of agriculture since 1890, enough has been learned by observation and special inquiry to justify the assurance of a very important increase in the practical reclamation of lands and the growth of cereals in many sections of the

State within the past two years. Thus we have the authority of the State engineer for saying that, whereas the total area in wheat at the date of the census was but 4,538 acres, there are reasons for believing that some single-water divisions exceeded that amount in 1892. Thus, Converse County, with but 6 acres of wheat in 1890 had 1,200 acres in 1892. Carbon had but 56 acres in 1890 but 1,000 acres in 1892. Uinta County, with only 315 acres in 1890, had over 4,000 in 1892.

Oats and barley have had a corresponding increase. "Speed the plow" is the motto in many quarters, and it is daily becoming more popular. Flouring mills are building in sections where hitherto every pound of flour consumed was imported. And yet there is room for improvement in this whole domain. Only a beginning has been made.

#### CAUSE OF SLOW DEVELOPMENT:

With \$10,000,000 invested in ditch lines, with an aggregate ditch mileage of some 3,000 miles, and some 2,000,000 acres of land under ditch, we are bound to attempt some explanation of the foregoing rather meager results in the production of crops. And this will not be a difficult task for those who are familiar with the history of Territory and State.

First of all, much of the ditching was done to get control of land. The desert act made it easy to acquire title, and in some cases sharp practice doubtless made it still easier. Hundreds of miles of ditching were used for this sole purpose, without any idea of immediate cultivation. The ditch made it possible to secure the land deemed desirable; and the lands once secured, whole valleys might be controlled, sometimes, no doubt, with a view to future cultivation, but often purely for the sake of holding vast areas of both meadow and grazing lands for stock purposes merely.

Secondly, much ditching was done with the sole or at least the chief purpose of gaining control of water, under the false impression that the mere diversion of a stream gave future control of its water. There are many ditches of such origin, whose mileage is real but without practical results in the watering of lands.

Thirdly, with the drop that came in the stock business and the crippling of both corporations and individual operators, many legitimate and worthy irrigation enterprises were stopped ere completion for want of means.

Finally, the slow progress of railway construction has been a very serious retarding cause. Those portions of the State best suited to agriculture on account of their lower altitude have especially suffered. There can be no profitable wagoning of grain, much less potatoes and root crops, a distance of several days' journey. With railways near by and markets at their doors, the farmers of Wyoming will take new courage and surprise the world with their achievements.



## GARDENING.

Perhaps it is not more true of Wyoming farmers than of farmers generally in the newer regions that they are rather deficient in the matter of gardens. Great distance from all exterior sources of supply, with consequent extra cost of everything imported, and with loss of that freshness so desirable, would seem to be reasons sufficient to prompt to the early making of gardens; but in his travels over the State, except in a few sections, one passes ranch after ranch having no sign of so much as a thought in that direction. In the valley of the Laramie, in the neighborhood of Saratoga on the upper North Platte, at a few points on the Bear, in the Lander Valley, and at a greater proportion of places in eastern and northeastern Wyoming, something has been accomplished, and a few have gardens of which a Downeaster might be proud—enough to demonstrate the capabilities of soil and climate in this regard.

It should not be claimed that the quite tender vegetables succeed at the high altitudes, but in all the lower districts cucumbers, tomatoes, watermelons, and the whole list of garden stuffs are grown without trouble. The report from Newcastle is, "Success in this line is phenomenal."

There are a few market gardens near the larger towns, but not so many or of such importance but that Cheyenne, Laramie, and other cities on the railway import most of the garden products consumed from Colorado, Utah, and Nebraska.

## FRUIT CULTURE.

Fruit growing is, of course, still in the experimental stage—just as it was in Wisconsin when the writer first entered that then unpromising but now very interesting field. It can not be supposed that any of the more tender fruits, such as all the larger fruits are, comparatively speaking, will succeed to any great extent in a region 6,000 feet above the sea level, and with exposure to winds more than ordinarily dry. But the experiences of other cold regions should suffice to give encouragement and lead to all reasonable efforts. It is better to begin with such as are known to be hardy, and to make steady progress than to attempt things in this line almost certain to result in failure.

The grape, raspberry, gooseberry, dewberry, strawberry, and cherry are all native to the country. In rambles among the foothills one is often able to regale himself to satisfaction upon delicious fruits of these kinds. It is reasonable to assume, therefore, that improved varieties of them can be cultivated with success. They will require the best sheltered location, watering by trenches two or three times during the season—once thoroughly just before winter, to prevent drying out—and such as can be laid down, or lopped over, should be covered with earth at the beginning of winter and allowed to remain thus protected until the full opening of spring.



The varieties recommended are these:

*Gooseberries*.—Houghton, Downing, Industry.

*Raspberries*.—Turner, Cuthbert, Yellow Caroline, Black Gregg, Mammoth Cluster.

*Strawberries*.—Wilson, Sharpless, Crescent, Iron Clad, Jocunda, Triumph.

*Currants*.—Red and White Dutch, Cherry, White Grape, Fay, Black Lees.

*Blackberries*.—Wilson, Snyder, Lawton, Colossal, Early King.

*Grapes*.—Concord, Delaware, Moore's Early, Wilder.

*Cherries*.—Ostheim, Richmond.

*Plums*.—Native varieties from seed, German Prune, Miner, Weaver.

Apples may also be attempted with some hope of success if we are content to limit ourselves to the very hardiest, beginning with the crab, such as the Transcendent, Hyslop, Siberian, Yellow Transparent, Briars Sweet, and General Grant. These will succeed with fair treatment as to exposure, watering, and mulching, and will make a most desirable addition to the comforts of a mountain home.

If any are yet more ambitious and would also grow apples of larger size, and even pears, let them observe the following rules:

(1) Plant none but Western grown trees.

(2) Be not ambitious for trees of so large a size that a considerable proportion of the roots must be sacrificed in removing from nursery and planting.

(3) Plant no young tree, however good in itself, whose rootlets have been dried by exposure to sun or wind. Better pay more and have them arrive with roots properly sacked and with a bole of their native soil.

(4) Plant in a locality as well sheltered as possible, and not in a place too low and wet, though where the trees can be reached with water.

(5) Plant with greatest care. Make the opening large enough to well receive the roots; set the tree at about the height in the soil at which it was; carefully work in the soil about the roots as the filling proceeds, and water well when the planting is done.

(6) Mulch in the fall, being careful about protecting the bark of the stem from the mulching material.

(7) Thoroughly water late in the fall, to prevent drying out during the winter.

The following varieties will probably stand the climate as well as any:

*Apples*.—Ben Davis, Wealthy, Dutchess, Tetopsky.

*Pears*.—Bartlett, Clapp's Favorite, Flemish Beauty.

#### MARKETS FOR FARM AND GARDEN PRODUCTS.

At the larger railroad towns there is market for a good deal more of all sorts of farm, garden, and dairy products than are raised at present, potatoes in some cases excepted; but at many points remote from

railways, as in the Snake, Wind River, Big Horn, Sweetwater, Powder River, Belle Fourche, and Goose Creek valleys, lack of home market is the great drawback. At some of the towns, where the production of wheat is considerable, flouring mills have been erected which furnish a more immediate demand for at least so much as is consumed on the spot; but in many cases wheat, if produced at all, must be hauled by teams from 100 to 150 miles and exchanged for flour to be hauled back in turn.

The extension of the Fremont, Elkhorn and Missouri Valley Railway into the Sweetwater and Lander valleys, the building of the Grand Island and Northern Wyoming Railway through Crook and into Sheridan counties, with a spur into Johnson, and the construction of a branch of the Northern Pacific up the Big Horn Valley, all of which are bound to come earlier or later, will afford greatly needed help to farmers already at work and insure the early and rapid development of those fertile portions of the State.

#### PRICES OF FARM LABOR AND FARM PRODUCTS.

The prices paid for farm labor vary from \$20 per month, with board, to \$25, \$30, \$35, and \$40, the average for all sections being about \$30 or a little over.

The prices received for products of the farm, dairy, and garden for the districts reported are as follows:

*Cheyenne, Laramie County:* Hay, \$7; oats, \$1 per cwt.; butter, 20 cents per pound.

*Laramie, Albany County:* Hay, \$8; potatoes, 60 cents per bushel; butter, 25 cents; peas, in pod, onions, beets, etc., 3 cents per pound.

*Saratoga, Carbon County:* Hay, \$10 (\$15 baled) per ton; oats, \$1.75 per cwt.; wheat, \$2 per cwt.; potatoes, \$1 per cwt.; cabbage and other vegetables, 2 cents per pound.

*Rock Springs, Sweetwater County:* Hay, \$12 to \$20 per ton; oats, 2 cents per pound; potatoes, 1 to 3 cents per pound.

*Ernstson, Uinta County:* Hay, \$8 to \$10 per ton; oats, \$1.25 per 100 pounds; potatoes, 75 cents per 100 pounds; wheat, 70 cents per bushel.

*Lander, Fremont County:* Wheat and oats, 2 cents per pound; potatoes, 1 cent per pound; butter, 30 to 40 cents per pound; eggs, 30 to 40 cents per dozen.

*Big Horn, Big Horn County:* Hay, in stack, \$10 per ton; wheat, 2 cents per pound; oats, 2 cents per pound; potatoes,  $1\frac{1}{2}$  cents per pound; other roots and vegetables, 2 cents per pound; butter, 40 to 50 cents per pound; eggs, 40 to 50 cents per dozen.

*Sheridan, Sheridan County:* Wheat, \$1.15 per 100 pounds; oats, 80 cents per 100 pounds; barley, \$1.25 per 100 pounds; potatoes, 75 cents per 100 pounds; butter, 25 cents per pound.

*Buffalo, Johnson County (1891):* Wheat,  $1\frac{1}{2}$  cents per pound; oats, old 2 cents, new 1 cent per pound; potatoes,  $\frac{3}{4}$  to  $1\frac{1}{2}$  cents per pound; butter, 35 cents per pound; eggs, 35 cents per dozen; cheese, 18 cents per pound; roots and vegetables, 1 cent per pound.

*Converse County:* Hay, \$10 per ton; oats, 75 cents per cwt.; potatoes, 1 to  $1\frac{1}{2}$  cents per pound; vegetables, 2 cents per pound; butter, 25 cents per pound; eggs, 30 cents per dozen; all at ranch.

*Smidance, Crook County:* Wheat, 80 cents per bushel; oats, 75 cents per 100 pounds; potatoes,  $\frac{1}{2}$  to  $2\frac{1}{2}$  cents per pound; onions, 5 cents per pound; cabbage and other vegetables, 2 cents per pound; butter, 25 cents per pound; eggs, 20 cents per dozen.

## THE LIVE STOCK INTEREST.

The live stock interest has undergone a number of changes since its beginning in Wyoming, some twenty years ago. There were at that time very few herds in the Territory. Bands of buffalo, elk, antelope, and deer occupied the ranges and it was an unsettled question whether domestic animals could be so managed both summer and winter as to make such enterprises both sure and profitable. The severity of one or two winters after the first experiments brought discouragement, but subsequent trials were so highly satisfactory that stockmen of the Western States were induced to drive in herds of cheap cattle from Texas and to occupy ranges of their own choosing.

## STOCK ON THE RANGE AND ON THE FARM.

## CATTLE.

Thus began the range industry of Wyoming. A "home ranch" built of poles on some stream of pure water for headquarters, a number of cowboys supplied with a band of bronchos for the round-ups, and led by a competent foreman, a few pairs of horses for teaming purposes, with wagons for the transportation of supplies and tents for the floating camps, constituted the full outfit of such parties as sought to make for themselves fortunes in the free use of the boundless pastures of that finely watered and magnificent region.

The very romance of such a business attracted men of an adventurous spirit, and when the first trials had shown the money there was in it the number of herds thus driven multiplied rapidly. Many men of the East and of the Old World who were able to command the requisite capital made large investments, and there was soon an ambition among them for supremacy. More capital was drawn upon, stock companies were organized, some of them owning their tens of thousands of cattle, and soon there were "cattlekings" in considerable number. But a territory 50 per cent larger than all New England was not to be filled up in a day, and there was still no thought of a crowded condition for a number of years. There was some general understanding as to about what portion of the country each party regarded as more particularly his own, but there was neither let nor hindrance after all; each manager led his herds whither he would and, when in search of more foreign capital for added herds and grand consolidations, made claim to almost any area short of the whole of Wyoming.

The "round-up" in the spring for the branding of calves and the fall round-up for the gathering of beeves for market were periods of intense activity. The Territory was then literally alive with cow boys, each in picturesque attire and with relay of ponies, prepared to scour every nook and corner within the range of 100 miles or more. No cup-like hollow in the mountains, no clump of pines, or cottonwoods, or aspens, no narrow, rocky cañon, however secluded, could escape the search of



these bold and dashing riders, these emulous scourers of mountain, valley, and plain.

The success of cattle-raising was then without precedent. The best possible material conditions, coupled with prices for beef in all the great markets which soon doubled the value of herds, made the money-making business of the time, so that capitalists were eager to embark in it. Great additional numbers of cattle were brought in from the Southern and Pacific ranges. Breeding herds were established, with blooded males of the breeds believed to be best suited to meet the requirements, and by 1884 the Wyoming Stock-Growers' Association had become the most powerful body of its kind in the world. The total was estimated at 2,000,000 head of cattle, worth an average of \$30 per head. In that year the Union Pacific Railway Company's delivery of cattle at Omaha amounted to 166,000 head of beeves.

But with the dawn of 1885 there came a decline in the prices of beef, then a little looking into matters by some of the heavy investors, who had been all too content while things were at high tide, then a questioning of tallies, a careful study of how to make up for the fall in prices, in a word, the beginning of a new era in the cattle business. New men were not so eager to embark in it, and some who were in were willing to try something else, especially after one or two severe winters with extra losses. It was at the end of that memorable year that Governor Francis E. Warren said in his report to the Secretary of the Interior:

The rearing of cattle in the Territory is to-day as profitable as it ever was, but it has lost much of that speculative sell-and-buy-without-tally, anything, and-any-price-to-get-into-the-business buoyancy that has characterized it. The prices of stock cattle have advanced to a figure where investors, while willing to pay current rates, want to know to a certainty that they are getting what they pay for as to grade and condition of cattle. There is also a growing conviction that this business will not longer "run itself," and that owners must give at least some small percentage of the attention necessary to accomplish success in other industries, and there is also a prevailing disposition to provide against emergencies, as by the putting up of hay for the weaker ones, the providing of shelter for thoroughbred and fine stock etc.

Still another cause of discouragement to stockmen and companies owning great herds had begun to make itself felt: the beginning of experiments in agriculture with the fencing up of streams for miles at a stretch; the running of wire fences around large pastures for exclusive use, thus destroying the freedom of the ranges; and yet another, when, because of these changes, men, seeing the coming decline, began to introduce sheep upon the plains, and thus to establish incompatibilities; and still another, when the fierce winter of 1886 destroyed its 10, 20, 30, and even 50 per cent of many herds. Then began the collapse of great corporations and the moving of many thousands of cattle into Montana, whose still unerowded ranges afforded the conditions no longer found at home.



But the other causes were secondary and incidental. Agriculture was the first and most important of all. Indeed, it is hardly too much to say that the inauguration of farming in Wyoming was the beginning of a revolution in the industry of that whole region of country. Even prior to this inauguration some of the very important changes alluded to in the foregoing extract had come, especially a more general attention to the improvement of herds by the introduction of blooded stock in every class, and in the growing recognition of the economy of some sort of winter provision for such superior animals as were added for this purpose. The demands of the domestic market, with a natural ambition to increase the foreign demand for Western cattle, stimulated this movement to such an extent that efforts to grade up and thus advance the reputation of Wyoming herds soon became universal. And it was these very efforts that led to those experiments which, at first here and there, and ere long in all sections of the Territory, demonstrated its agricultural capacity. The most valuable of forage crops succeeded to a degree that surprised the experimenter. The tame grasses grown in the great valleys of the Northwest could be grown here also. Alfalfa could be made to yield three crops a year. Oats, barley, millet, field peas, fodder, sorghum, and even field corn made in many cases extraordinary demonstrations of the capacity of both climate and soil. Rutabagas, carrots, white turnips, and artichokes grew to perfection and supplemented the other crops in a most satisfactory manner.

All this led to one step further. Crops for the family use were naturally attempted, and soon spring wheat, spring and winter rye, and buckwheat were seen responding to this demand also.

Stockmen of means, in thus proving not only the capabilities of both climate and soil, but also the magic power of water as applied in systematic irrigation, presented object lessons which people of less means and with fewer cattle were quick to learn. Unable to construct large ditches for the watering of table and bench, as well as valley lands, they confined themselves to the borders of the smaller streams, diverting the water into cheap ditches of their own construction and fencing in their growing crops.

Nevertheless, stock-growing has remained and must always continue to be an important branch of industry in Wyoming. In portions of the State where there are quite extensive areas of good grazing country with only springs or very small streams and rivulets for water supply, and hence no possibility of doing much in agriculture, and where, moreover, the early stock-grower has been careful to possess himself of all such spots as could offer the slightest inducement to farmers, the cattle king still holds sway. But for the most part the cattle of Wyoming will soon be found in segregated bunches as numerous as they who occupy the valleys for agricultural purposes, each farmer holding his own and keeping them so in hand that by means of the forage cut and stacked for that purpose he can bridge over the winter with the smallest percentage of loss.

That the new order of things will eventually be better for the State is even now manifest. There is not so much poetry in mixed farming as there was in the cattle-king business, but it seems certain to more than bring compensation for all the losses sustained by the comparatively small number of operators who have been constrained either to fall into harmony with the new conditions or to try their fortunes in other fields still unvexed by agricultural innovations.

Properly speaking, agriculture includes not field culture alone, which the etymology of the term implies, nor yet soil culture alone, inclusive of field, orchard, and garden, but also stock-raising as well, since domestic animals of some class become necessary to the farmer as a means of economy in the use of various crops. A very considerable proportion of the farmer's crops, exclusive of breadstuffs, especially at points remote from the centers of population, is produced for consumption at home. Herds of horses, sheep, cattle, and swine afford him the advantages of an immediate market for such bulky crops as would not bear the cost of transportation until condensed in muscle for service, or in beef, pork, and wool for consumption at places remote from that of production. This is especially true of communities so far removed as Wyoming from the great markets of the country.

There is no sufficient reason why the "cattle on a thousand hills" should dwindle in numbers. On the contrary, there are good reasons why they should increase. The same characteristics which have made Wyoming first in the estimation of so many stockmen are still as marked as ever. The finest climate in the world is still almost everything that could be desired; cool and bracing in summer and winter, dry and temperate in winter, the air always pure, with an abundance of electricity and ozone. The magnificent country itself is there, with its varied surface of mountain, valley, and plain, affording every variety of exposure with shelter ever near; the soil also for the most part dry, porous, and firm, thus insuring soundness and toughness of hoof; the pure water of river, creek, and lake, and last of all, the finest grasses known under the sun, affording not only the best of summer feed, but also a feed, better than standing hay for fall and winter use; the compound result being still, as of yore, immunity from disease, vigor of body, unusual development, and, in short, a superior product in every respect. Moreover, Wyoming is no less near than before to the vast and fertile areas of Nebraska and Iowa, with their cheap corn, affording good opportunity for the limited amount of feeding necessary to the production of corn-fed beef at the least possible cost, should the stock farmer find a brief halt for such a purpose while en route for eastern markets to any degree advantageous. Nor have the facilities for the production of wool and mutton been forever lost; nor those in which the breeder of horses has hitherto rejoiced—all those conditions requisite to the toughness of fiber, nervous energy, lung power, and great endurance which are everywhere esteemed as highest results. It will be found that the new order of

things will early produce a greater number of cattle, and cattle of better quality, while admitting of the proper settlement of a State immensely rich in its varied resources and in dotting the hundreds of its charming valleys with happy homes.

It might have been still better for agriculture had the change come sooner—before stockmen, caring only to possess the country, or at most to put up hay for winter feed of horses and blooded male cattle, had gained control of so much of the best valley land. But time will make all things even. The farmers who buy those lands eventually will have to pay more for them, but they will enter into possession under better general conditions.

At present there is one embarrassment felt by all who attempt enterprises of this sort, namely, the difficulty, if not practical impossibility, of acquiring title to the grazing lands adjoining the valley ranch and necessary to the safe prosecution of the live-stock business. If there could be such legislation as would meet the conditions found in the arid region, so that titles to the contiguous grazing lands could be acquired, with additional provision for water gaps at proper intervals, there would then be, what there is not now, a possibility of utilizing both the grazing and the agricultural resources of the Rocky Mountain region. There should be practical wisdom enough among the people of the arid belt and in Congress to bring about this important result without much longer delay.

The growing limitation of cattle to small herds within range of the farmer's home is making corresponding and very important changes in the quality of cattle raised. It is becoming the rule with farmers, as it was beginning to be with range cattle-owners, to import blooded males for breeding purposes, some preferring the Durham, others the Hereford, not a few the Galloway and Angurs, and some the Holstein breeds. By this means noticeable changes have been effected already, and they will of course annually become more apparent, with heavier cattle, better beef, and superior prices as rewards for the producer.

Improvement of the stock by introduction of blooded animals will also increase the demand for winter feed, and thus lead to the cultivation of the grasses best suited to this use. Already timothy, clover, and alfalfa are receiving greatly increased attention among systematic and ambitious farmers in all sections of the State.

While, therefore, the causes already alluded to did actually lessen the number of cattle in Wyoming by 25 to 50 per cent, as compared with 1884, the number is again steadily rising, and but for the increasing attention to horses and sheep as just now affording an equal or greater profit, would soon reach the former figure or soon exceed it. There is yet room enough for improvement by the infusion of better blood and the liberal use of feed and shelter for the finer-blooded males, unaccustomed to rough it, for cows that have not summered well, and for the weaklings of every age and description. In many localities



these have already come to be considered essential conditions of success. Returns lately received show this to be notably the case in the valleys of the upper North Platte and the Laramie, in Laramie and Converse counties, in the region about Newcastle, in Sheridan County, in the Lander Valley, in the prosperous valleys of the west side branches of Green River, and in the valley of the Bear.

The common stock is brought in, as formerly, from the States and Territories farther west, a large proportion from Utah, Idaho, and Nevada; some also from Colorado and Texas. Blooded males are largely brought from Iowa and other Western and Northwestern States. The markets for Wyoming beeves are Omaha, Chicago, and Kansas City. The common ages at which cattle are sent to market are 3 and 4 years.

The dairy business has not yet been practiced to any marked extent in other than a few districts. No creameries proper seem to have been established, and it does not appear that there are any cheese factories. Ordinary dairying is quite a business, however, in Johnson County, in the neighborhood of Cheyenne, Laramie City, and Saratoga; doubtless also in other places not reported or personally known to the writer. The breeds preferred for milk and butter are the Jersey, Alderney, Ayreshire, Holstein, and Shorthorn. In summer the grass on the range is sufficient, but in the winter hay, fodder, and roots, such as turnips, rutabagas, and beets and carrots, are added.

#### HORSES.

Were it not that in recent years the market for horses has also been unsatisfactory, horse-ranching would be deservedly popular in Wyoming, since the conditions are all exceedingly favorable. The superior quality of the native grasses; the abundance of good water; the exceeding purity of the air, so thin as to give extraordinary lung development; the dryness and hardness of the soil, favorable to soundness of hoof; a climate not only the most healthful in the world during summer, but also winters characterized by snowfalls so light that the horse is rarely prevented from getting at grass enough to meet his daily needs, and, what is also important, as complete immunity as any part of the world can furnish from the annoyance of tormenting flies and insects of every description. Such are the advantages to be placed to the credit of this favored region.

This same view is well expressed by Governor Thomas Moonlight, in his report of 1887 to the Secretary of the Interior, in which he says:

The three fundamental requisites of a good horse are to be found in almost all the Wyoming-bred horses of every breed, viz, constitution, lung power, and good feet. It is a rare thing to find a horse bred and raised in the Territory that has not a strong and enduring constitution, with clear, bright eye, and a frame knit together for hard service. They can stand more hard work and wear and tear than any horses I have ever seen. The altitude and the pure, bracing air, combined with the natural exercise on the plains and mountain sides from colthood to maturity give them a



lung power fit for any emergency. This enables them to be speedy, as well as strong and hardy, and they never appear tired or oppressed in the hottest days in summer. Their feet are compact and neither too large nor too small, but round and strong, with walls and frogs to support the animal. The plains are naturally dry and the surface hard, containing something of a mixture of decomposed granite, with sand, clay, and loam, which has an influence upon the growth and formation of the hoof. I have never seen a Wyoming-bred horse with poor feet.

The bunch, buffalo, and other short grasses are seemingly just what the horses need to give them strength and vigor, and they can stand more hardship and endure more cold and longer storms than the cattle can. When the winter blasts sweep across the plains the cattle drift before their fury until they cease, or they find comparative shelter, but the horses brace up against it with courage and mettle, picking up what the storm has failed to cover, or pawing away the snow, defy wind and weather. They can survive upon snow better than cattle, and it is a rare thing to find a horse dead from lack of food, water, or shelter.

Confirming this in every particular, Mr. A. S. Mercer, of the North-western Live Stock Journal, a man especially well informed upon this whole class of subjects, adds:

In a word, the nature of the soil and feed and the climatic conditions give a wonderful lung capacity, sound feet and legs, with endurance and high courage; and these make the horse. Seventy-five to ninety miles are common drives for double teams in a day over our trackless prairies with the common ranch horses. What we may reasonably expect from the young crop of improved animals now coming on is so far in advance of our past experience that we hardly dare name it. It is safe to say that the time is not far distant when the horses of Wyoming will be as widely known and as generally appreciated as are the record-beaters of California and Kentucky of to-day. To the lover of the horse who contemplates entering into the business of raising good ones there is no other spot in all the broad land offering greater inducements than Wyoming.

It is not surprising, therefore, that even with rather a cloyed market there are those who find themselves willing to let go of cattle and take up horses instead. And yet it must be confessed that only here and there has horse-breeding received anything like the attention it deserves. The whole number in the State must be approaching 200,000. But of this number the great proportion are the smaller animals, suited to the work of "cow ponies," rather than to uses that would command for them prices yielding a handsome profit. They are also mostly found in small bands of 50 to 100, although at a number of points there are herds of several hundred. Even in herds such as these there is usually a sprinkling of colts produced by crosses with improved breeds; but it is nevertheless true for the most part that up to this time the business has been incidental rather than primary, and has been managed with but little of either capital or skill.

The most important undertaking in this whole branch of business thus far was that of Hon. Morton E. Post, of Cheyenne, and his New York associates, who established a ranch on Pole Creek, a few miles north of Cheyenne, in 1884. By leasing a large body of railroad lands and throwing wire fences around them and the alternate Government sections they were able to control very large areas for their own exclusive use. The requisite ranch buildings of every sort followed; fine

brood mares and blooded stallions were gathered in, and the enterprise soon came to be regarded as the most important of its kind in that whole region of country, both because of the superior equipment and its superior herd of between 2,000 and 3,000 head. It was soon crippled, however, by the action of the Government in ordering the removal of all fences inclosing the public lands, as well as by other embarrassments common to the stock business of that period, and has not shown the results that must have followed under more favorable conditions.

The breeds used for the improvement of native herds and herds driven in from Idaho, Nevada, and the Pacific coast, possibly also from Colorado and western Texas, have been largely of the heavier class, on the theory, of course, that only such could grade up the pony breed to a proper size, and that there is more profit in draft horses than in others. The Normandy, Percheron, and Clydesdale breeds are those in most demand, and they have been employed in sufficient numbers already to produce very considerable results. The French coach horse is in favor with some. Light harness and saddle horses have also received attention, the Cleveland bay and the Hambletonian especially, and a few breeders, notably Mr. A. C. Beckwith, of Evanston, have made a record in the way of producing trotting and running horses, such as have gained a reputation abroad.

The demand at times for saddle horses suited to range use was so considerable during the palmy days of the cattle business that four-year-old colts of native stock, with a slight cross, sold in bands of thirty, forty, and fifty, at prices varying from \$50 to \$75; while improved horses on the range, duly furnished with well-bred stallions, were valued at \$70 to \$100 by the lot, the stallions included.

Touching the matter of profits, Mr. N. R. Davis, of Cheyenne, long in the business and thoroughly acquainted with its status and possibilities, was quoted by Governor Warren, in his report to the Secretary of the Interior for 1885, as saying:

With ordinary success it will pay 20 per cent; some make much more, others less. The cost of raising a three-year-old colt will vary with the cost of mares and stallions and the size of the herd from \$15 to \$40, and breeding will cost from \$10 to \$15 more. This estimate allows for feed of stallions the year round and for feed of colts while breaking. At other times the colt is on the range, and the mother is never fed. It is well established that horses, unless worked, do not require to be fed at any season.

It is believed by the writer that a profitable branch of this general industry could be conducted by devoting special attention to the breeding of horses especially suited to carriage use—not so heavy as the coach horse, nor so light as roadsters, but combining the desirable qualities of both—horses of smooth and handsome build, with stately carriage, and with sufficient spirit to make them agreeable to all lovers of this noblest of animals. With the best of mares from the Western and Northwestern States, and males of the Cleveland Bay, Hambletonian;

and other breeds of like general character, one could hope to produce in Wyoming, in course of time, such animals as would bring high figures in the Eastern or foreign markets.

Whatever the present discouragements, horse ranching in Wyoming seems surely destined to become one of the most important of her many promising industries.

#### SHEEP.

Sheep husbandry had an early beginning in various sections, but did not succeed in getting itself established to any important extent in more than two or three quarters until the beginning of a decline in the cattle business, which, up to that time, had been not only more attractive to those who could follow it, but also more profitable. Hon. Morton E. Post, then of Cheyenne, and Hon. Francis E. Warren, at present United States Senator, were perhaps the first to take it up in a thorough fashion; and the latter has, with credit to his pluck and farsightedness, been among the most persistent in holding on to it. He also had investments in cattle and horses, with varying amounts in each class, but his sheep ranches received not only constant but ever-increasing attention. Fortunate in his location of ranges, which he managed to control by securing the land for many miles along their course, fortunate also in securing the coöperation of able, practical assistants, and foreseeing, no doubt, the coming changes in the industries of the State, his company has added ranch to ranch and herd to herd until he might now be called the chief shepherd of Wyoming.

In view of these facts I can hardly hope to make a better presentation of the facts requisite to an understanding of both the advantages of sheep husbandry and the conditions of success than by quoting from his report of 1885 to the Secretary of the Interior, while holding the office of governor of the Territory. He then said:

Nearly all the grazing lands of Wyoming are adapted to sheep-growing, and the Territory contains at the present time about 1,000,000 head, but this number is small compared with the field, and shows a slower ratio of increase than that recorded of horses and cattle. The demoralized state of the wool and woollen goods market, and consequent low prices the past few years, have doubtless prevented the more rapid growth of this industry.

Very little loss is sustained on account of disease. The dryness of the soil not only prevents the foot-rot, so common East, but sheep affected with it when brought here are readily cured, in fact speedily recover without applying any remedies. The only contagious disease known here is scab, and this with proper care never kills, and is readily cured.

A gentleman who has spent many years in the business offers the following facts touching the usual mode of procedure in stocking a ranch in a quite moderate way, together with the profits of such an enterprise:

"The smallest number with which an economical beginning can be made is 1,500 head. It will cost no more for improvements and help to manage this number than to manage 1,000. The beginner will carefully select his range with reference to feed, protection from storms, water, and meadow land. If he would commence with 1,500 head of Mexican sheep his improvements—cabins, corrals, etc.—need not cost him



over \$500. He will buy picked white yearling ewes of the desired number at about \$2 per head, delivered on his ranch, locating them late in October, care having been taken to put up a few tons of hay.

"Many flocks go through the entire winter without a particle of any feed but grass, but the provident husbandman will put himself on the safe side. To the desired number of ewes he will add Merino bucks in the proportion of one to fifty ewes. These will cost him about \$15 to \$20 per head. The whole flock will require but one shepherd. The increase will amount to about 85 per cent of the whole number, and will be worth to him about twice as much per head as the original flock. The shearing will cost him 6 cents per head, incidentals included. The yield of wool from the Mexicans will be about 2 to 3½ pounds in "the dirt"; from the bucks, about 15 pounds per head. The profits will of course depend on the market price of the wool clipped. During the past year the Mexican wool has brought 12 cents per pound; product of the first cross 20 cents. The gentleman referred to assures me that on a flock of 1,500 sheep, purchased as above and managed on shares, the contractor incurring all the expense for improvements and equally dividing the product and the increase, he had netted 60 per cent per annum, or 180 per cent in three years."

I also present Governor Warren's quoted statement of the cost and profits of the business, notwithstanding the interval of time since it was made and the somewhat modified conditions, especially as the important difference between the past and this present is that of an enhanced price of the product:

To make the whole matter more clear, I give the following restatements of the cost and profits of establishing and managing a ranch with 1,500 head of sheep during a term of two years.

The loss allowed on following statement (10 per cent per annum) is much larger than will occur from disease or natural deaths, but it has been found necessary to add something to natural losses on account of accidents that occasionally occur in severe winter storms:

*First year.*

Cost of improving ranch.....	\$500.00
Cost of 1,500 picked white yearling and 2-year old Mexican ewes, at \$2..	3,000.00
Cost of 30 Merino bucks, at \$15 .....	450.00
Cost of hay that may be used .....	100.00
Cost of incidentals .....	25.00
Pay of herder, at \$25 per month .....	300.00
Board of herder, at \$10 per month .....	120.00
Cost of shearing 1,350 head (original 1,500—less 150 lost), and 30 bucks, at 6 cents per head.....	82.80
Interest on above amounts, at 12 per cent.....	549.34
Total cost, expense, and interest .....	<u>5,127.14</u>

*State of account at end of first year.*

Value of 1,350 two year-old ewes, at \$2.25 each.....	\$3,037.50
Value of 30 bucks .....	450.00
Value of improvements.....	500.00
Value of clip from 1,550 Mexican (3 pounds per head), at 15 cents.....	607.50
Value of clip from 30 bucks (15 pounds per head), at 15 cents .....	67.60
Value of the 85 per cent increase (1,275, at \$1.25).....	1,593.75
Total inventory.....	<u>6,256.25</u>
Deduct cost, expenses and interest on investment.....	<u>5,127.14</u>
Profit end of first year over and above 12 per cent.....	<u><u>1,129.11</u></u>



*State of account at end of second year.*

Value of original Mexicans, reduced by loss to 1,215 head, at \$2.25 .....	\$2, 733. 75
Value of Merino bucks, now 50, at \$15 each.....	750. 00
Value of 1,147 cross yearlings (1,275, less 10 per cent loss), at \$2.50 per head .....	2, 867. 50
Value of improvements .....	750. 00
Value of clip from 1,215 Mexicans (3 pounds each), at 15 cents .....	546. 00
Value of clip from 50 bucks (each 15 pounds), at 15 cents.....	112. 50
Value of clip from 1,147 grade yearlings (6 pounds each), at 21 cents.....	1, 445. 22
Value of 1,034 lambs (85 per cent of 1,215), at \$1.25 .....	1, 292. 50
Total inventory .....	10, 498. 22

From this deduct:

Cost of 23 additional bucks, at \$15 each .....	\$345. 00
Cost of additional improvements.....	250. 00
Labor .....	450. 00
Hay.....	100. 00
Cost of shearing 2,412 head, at 6 cents.....	144. 72
Interest on inventory, end of first year, \$6,256, at 12 per cent.....	750. 75
	<hr/> 2, 040. 47
End of second year's business .....	8, 457. 75
Deduct first year's inventory.....	6, 256. 25
	<hr/> 2, 201. 50

Second year's profit above 12 per cent, compound interest.....

"The above table is computed from a start in Mexican ewes, as in early days we had to depend largely on New Mexico for our supply of ewes for breeding; but at the present time there are plenty of first-class high-graded Merino ewes that can be purchased for about \$3 per head, that will shear 5 to 6½ pounds of wool (in the dirt), worth 18 to 25 cents per pound, which will pay a larger percentage than an exhibit based upon Mexican sheep.

"It can readily be seen that the third and fourth years and each successive year will grow more profitable as the young graded sheep mature and the flocks increase in size. The larger the flock or number of flocks under one management the less expense per head for taking care of sheep. Two thousand to 3,000 will as well range in one band with one herder as 1,500 will. Again, when a large number is under one management the flocks can be so selected that each size and sex can run together, the hardier taking the outside and most exposed ranges, and the weaker can be kept together on richest ranges."

The estimated number of sheep in the State in 1889 was 250,000; and to this it is thought there may have been since added nearly as many more by both breeding and importation. The more strictly agricultural portions of the State, especially Johnson, Weston, Crook, and Sheridan counties, appear to be the few sections in which this industry, if already established, has not rapidly grown. Twenty-five, 30, 50, and even 100 per cent per annum is the increase reported by competent witnesses to have been made in a number of localities, as in portions of Laramie, Albany, Carbon, Converse, Natrona, Sweetwater, Uinta, and Fremont counties. "Twenty-five to 50 per cent;" "Very large increase;" "Have doubled their number this year;" "Doubling annually at present;" "Have trebled in three years;" "Fourfold in five years"; "Taking the field;" "So fast that the ranges are getting crowded;" such are the answers to our question, "How far is sheep-raising on the increase in your section?"

The per cent of loss reported averages about 8 per cent; the lowest being 5 and the highest (that of lambs) 20 per cent. Many reporters say not more than 5 per cent, or 10 per cent, all told. As a rule, little or no provision is made for winter. It is not considered necessary, or is thought not to pay.

As with cattle and horses, but little attention was paid to breeding for improvement of blood, but now attention to this condition of the highest success is coming to be universal. Merinos, French and Spanish, are the breeds more commonly used for improving the native and Mexican sheep, but Shropshires, Cotswolds, and Southdowns are also in some demand.

The effect of this crossing with blooded sheep is said to be an actual increase in the value of the wool of from 10 to 25 per cent. The breeding is mostly for wool; the cost of production being, according to some estimates, in the neighborhood of 9 cents a pound. When mutton is the object the Southdown is the general favorite. Alfalfa is found to be one of the best and most economical kinds of feed for fattening purposes.

There is some complaint, a good deal in various quarters, of impairment of the ranges, and here and there is a conflict between the sheepmen and cattlemen on this account. The close nip and sharp hoof of the sheep will tell upon almost any range if the herds are too narrowly confined, and they also leave an odor which cattle and horses do not relish. But there seems to be no remedy of which the cattlemen can avail themselves, and accordingly when they are constrained to it they move out their cattle into districts not yet invaded, or sell out to outsiders and go into sheep-raising, or quit the country.

Cattle and horses have one advantage, however, in that they can make longer journeys to water than sheep, and thus are able under some conditions to hold exclusive possession of the ranges too remote from the streams for use by the shepherd. Whatever the difference of opinion as to the relative value of these conflicting industries in their relation to the general welfare of the State, the sheepmen certainly have the inside in the present contest.

#### GOATS—COMMON AND ANGORA.

As might be inferred, the climate, surface, and stock of natural grasses in Wyoming are no less favorable for animals of the goat species than for sheep. The demand for the product is so much less, however, that but little has been accomplished in this particular branch of stock-raising. Hon. Gustav Schnitzer, lately United States marshal for Wyoming and present State fish commissioner, was probably the first of our citizens to undertake the raising of Angora goats. The habitat of this variety of the goat species is Asia Minor, whose physical conditions are similar to those furnished by Wyoming. Hence the suggestion to his mind of a trial in goat husbandry. The animal has

been found to succeed well and the number has reached about 5,000 head. But as yet no reason has appeared for special efforts to extend the business. The mohair produced is of good quality and bears a higher price than wool, but the yield is enough less to offset the advantage.

#### SWINE.

Swine, until recently, have been almost unknown in Wyoming; there being neither a supply of mast in the forests nor a sufficient production of cheap corn in more than a few sections to encourage the production of more than a few head in a place for the consumption of wastes from the kitchen and dairy. In some of the lower districts of Johnson, Sheridan, Crook, and Weston counties they receive a little more than ordinary attention; indeed, they are reported as being raised in considerable number about Newcastle in Weston County. The breeds preferred are the Red Jersey, Berkshire, and Poland China.

#### FORESTRY IN ITS RELATIONS TO AGRICULTURE.

That the subject of forestry bears important relations to the agriculture of the country or section is manifest. The contribution made by forests to the beauty of the landscape and to the comfort of man and beast, by the refreshment they afford and the protection they offer against the blasts of winter and the scorching heat of summer, are but minor considerations, though by no means without value. There are other relations more vital.

In the first place, the direct value of forests to any given region of country as a source of fuel and timber is very great, as must have been painfully felt by early settlers of Kansas, Nebraska, and Dakota; whose necessity it was, in many cases, to make journeys of several days for a wagonload of poles for stable and corral; the whole of whose lumber for dwellings was of necessity imported from the East, at a cost so great that each one of those great and fertile districts had its period of "dig-outs" and turf cabins; and whose reliance for fuel in many instances was largely upon the corn they had produced from the soil.

The relations of forestry to climate and to water supply are yet more vital. Not so much because of the influence of forests upon the rainfall of a county, although this is alleged to be very considerable, as because of their conservation of the moisture precipitated in rain and snow, for the time of greater need. This they do both by affording shelter from the direct rays of the sun and by the retentive service of the deep beds of decaying leaves, twigs, and fallen trunks, which bank the snows and dam the waters; thus holding the one for gradual percolation and the other for slower and later melting away, to the end of a moderate and steady drainage for the benefit of thirsty valleys and plains, instead of that sudden and rapid discharge which must other-



wise fill all streams to an overflow and expose all valleys from the mountains even down to the sea to the peril of devastating floods.

Wyoming is especially fortunate in all these regards. Owing to the broken character of her mountain ranges, with wide stretches of plains, table-lands, and valleys between the scattered spurs, every division of her territory has its adjacent hills or mountains more or less thickly clothed with forests of pine, fir, spruce, hemlock, larch, and cedar, equal to the demands of a large population and suited to every domestic use; while at the same time rendering the last-mentioned incalculable service of making this vast elevated region, which must otherwise have been a barren waste, not merely habitable for man's purpose as an explorer for stores of mineral wealth, but also a magnificent empire of verdant plains for countless flocks and herds, and of fruitful valleys teeming with the best products of the temperate zone; presenting, all in all, such natural conditions of a delightful dwelling place as are but rarely found on the face of the globe.

Fifteen million acres of forest; what a legacy! Pitch pine and cedar for fence posts, railroad ties, and building timbers; fir trees standing in their majesty of loftiness, straight as an arrow, and 60 to 70 feet without a limb; spruce, also, and the other evergreen species, of exceeding beauty and value, awaiting the summons of man for uses without number; waiting there likewise on the mountain slopes as faithful sentinels, guarding his inheritance of a matchless climate and the possibilities of a thrifty and productive young empire.

In many parts of the world the timber limit is as low as 6,000 to 7,000 feet. Here it rises to 10,000 and 11,000 feet; not for stunted growths of scattering trees that seem to have tussled with the storms of numberless centuries, but thrifty young forests thickly studding the mountain summits. Such forests in such a region are a priceless inheritance in whose preservation and permanence every citizen of the continent, whether in the rugged wilds of the rocky range or in the broad valleys of the Missouri and Mississippi, a thousand miles toward the sea, has an interest, whether he knows it or not.

In view of the incalculable value of such supplies of timber in and of themselves and of their yet more vital relation to the agriculture of the country and to its climate, it is beyond comprehension that better, and the fullest possible, provision has not been made by the Government for their protection from the devastating fires which annually sweep vast bodies of them from the face of the earth.

#### GOVERNMENT HELPS TOWARD DEVELOPMENT.

The Government helps already accorded are important and have been duly recognized by our people. The Territorial government early took action in various ways for the promotion of our industrial interests; as by providing for practical geological, surveys; establish-



ing a fish hatchery, and creating the office of fish commissioner; enacting laws for regulating the live-stock business; creating the office of veterinary surgeon for the inspection of live stock and preventing the introduction of diseased animals; establishing a Territorial university with industrial departments; last of all, enacting wise laws in the interest of irrigation, and creating the office of Territorial and State engineer, with important powers and a sufficient staff of competent assistants.

In support of these judicious steps of Territory and State, as well as by the initiation of measures wholly independent, the General Government has made most important contributions to the success of these efforts of our own people and government. For a time it afforded extraordinary facilities for acquiring title to public lands. For the purpose of exploration and the settlement of important questions pertaining to our resources, it has sent out its ablest geologists, botanists, and topographical and hydrographic engineers. It has made liberal provision for examining into questions of water supply, as well as for locating and securing sites for public reservoirs with a view to the future needs of a growing agriculture. It has helped the State fish commissioner to supplies for the better stocking of our waters. It has guarded our herds by adopting effective measures for the extermination of pleuro-pneumonia. It has endowed the State University with lands and its agricultural college with 90,000 acres more, adding thereto a cash appropriation of \$15,000 for the year 1890, with an annual increase of \$1,000 for ten years, and with appropriations of \$25,000 per annum after 1900. It has appropriated \$15,000 a year from 1887 for the establishment of an experimental station or stations where shall be determined to the fullest extent practicable all questions affecting the prosperity and progress of agriculture in its every department; which appropriation has already secured to Wyoming an important station under the supervision of the director of the agricultural college, with six experimental farms, located at as many points in the State. It has given to Wyoming, in common with all the other States, the benefit of a great Department of the Federal Government, with large powers and unstinted appropriations of money for doing whatever may be done by a great and powerful nation for the best development of its resources—a Department whose helping hand has already accomplished much for these remote interior portions of the continent, and is certain to accomplish for it yet greater things in the future.

Apparently, but one great and important condition remains to be fulfilled, namely, such judicious revision of the land laws as will better adapt them to the peculiar needs of the arid region. If it be not deemed wise to bestow all the unsettled lands of the Government upon the States, to be managed by them, under proper restrictions, as they may think proper—and it must be confessed that serious difficulties lie in the way of such disposition of them—then Congress should itself early solve

the problem by securing to the people of these vast districts the means of more equitably and fully utilizing both the grazing and the agricultural lands of the State.

With such natural resources as are hers, with an intelligent and enterprising farming population, ambitious of success in the highest degree, and with such generous encouragement as has been and may properly be yet further accorded by the State and Federal governments, the future of Wyoming agriculture may be considered assured.





